July 1992 Issue #12

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Radio Fun

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"The beginner's guide to the exciting world of amateur radio."

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Father Moran, 9N1MM, Silent Key

Marshall Moran SJ, better known to the amateur community as Father Moran 9N1MM, passed away in New Delhi, India on April 15, 1992 of heart problems. He was 86 years old.

Father Moran's amateur radio career spanned the history of the hobby, from his first crystal radio in 1918, to his daily appearances on 20 meters (even within days of his death).

In 1951, Father Moran moved to Nepal to establish the St. Xavier School in an abandoned maharajah's summer palace. He remained there for 40 years. In 1960, he asked for and received the first amateur radio license in Nepal, 9N1MM.

Father Moran made almost 300,000 contacts from Nepal and assisted essentially every visiting ham to get on the air.

While not on the air, Father Moran ran the St. Xavier school with its 260 students. He held morning sick call, despite his lack of formal medical training, and he worked tirelessly to improve the education and spiritual well-being of two generations of Nepalese.

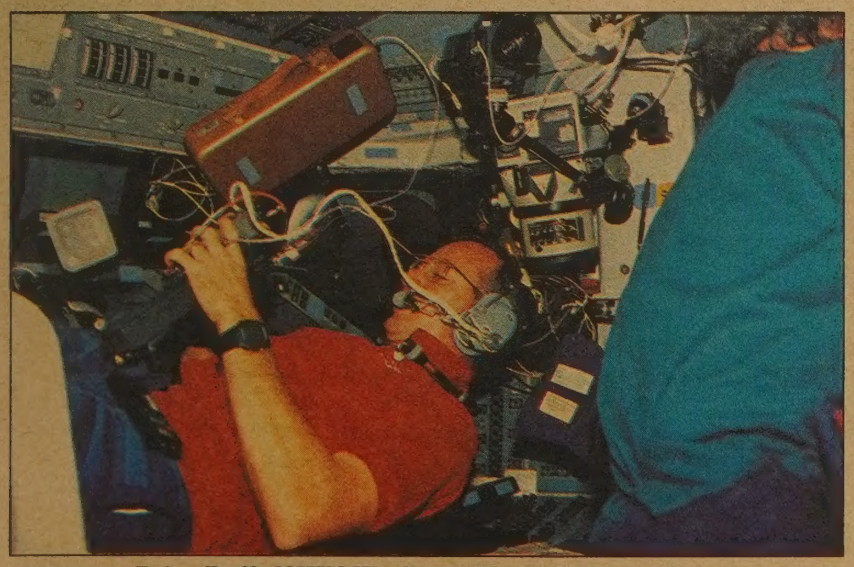
Rest in peace, 9N1 Mickey Mouse.

TNX to the DX Bulletin, April 24, 1992.

Kimberling ARC Girl Scout Demo

The Kimberling Amateur Radio Club, Kimberling City, Missouri, brought their emergency unit to the Stone County Girl Scout day campout on Saturday, April 25, 1992. Each girl was given a club brochure and other information about amateur radio as well as a chance on the mike. It was a good chance for some of the new members of the club to get acquainted with the equipment in the emergency unit, better known as "Old Faithful." (Photo and news courtesy of Jim Davis NQØG.)

STS-45 Success



Astronaut Brian Duffy N5WQW, pilot, talks to amateur radio operators on Earth from the flight deck of the space shuttle *Atlantis* during the STS-45 mission. ***(See the full story on page 16.)***

73/Radio Fun BBS

The *73/Radio Fun* telephone bulletin board system (BBS) is now available at (603) 924-9343 (up to 2400 baud). It's available free of charge to all callers and offers a wide array of public domain amateur radio programs you can download as well as news items and special interest forums.

DOVE Speaks Out!

The DOVE (Digital Orbiting Voice Encoder) satellite is currently on two meters on 145.825 MHz and is running a small engineering test of the speech module. This is DOVE's first voice from space.

The purpose of this test is to exercise the control and data lines of the DOVE module. The actual speech was kept as simple as possible, it is un-inflected speech from the phoneme generator - "You are listening to DOVE microsat." Three minutes of 1200 bps telemetry alternates with one minute of voice. Much better speech is expected once the final check-outs are complete.

This test is just part of a recent intensive period of engineering activity on DOVE, designed to find the cause of the control difficulties and to formulate a viable work around. This activity will continue, the current test is just the first milestone. The DOVE recovery team currently consists of Bob McGwier N4HY, Harold Price NK6K, Jim White WDØE, and the satellite's owner, Junior Torres de Castro PY2BJO. The first DOVE voice from space began at approximately 0515 UTC on May 24, 1992, while N4HY, NK6K and WDØE were engaged in a conference call.

We don't think we have all the answers yet, and much remains to be done before it is ready for its intended educational mission. DOVE may leave two meters from time to time as we continue the check-out process. *TNX to Harold Price NK6K and AMSAT for the above.*

International Environmental Radio Network

In the fall of 1991, when a Greek tanker spilled heavy crude oil off the western coast of Australia, it was a ham radio operator who discovered it and let the world know. Ham radio operators are often the first line of defense against natural and environmental disasters, sending word of toxic spills, tornadoes, and other dangers before the authorities or the press eat breakfast. It's no surprise that many ham radio folks are environmentalists: Their love of international communication, self-reliance, and technical fiddling are all traits that point to green.

Ham radio operator Robert Wilderman of Lansdale, Pennsylvania, is hoping to build on that propensity with the founding of an international environmental radio network called PLA/NET. For now the network is small—about 100 strong worldwide—and they "meet" only twice a month. But Wilderman has high ambitions for PLA/NET. He hopes to keep the network going at all times, have experts on

Continued on page 10

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CIRCLE 67 ON READER SERVICE CARD

Getting the Best Mobile Performance

Everything you ought to know about your mobile antenna.

by Don Crowder N5TWH

I do a lot more listening than I do talking on the local 2 meter machine and I hear a lot of controversies over the various types of mobile antennas and the equally various ways to mount them. Everybody seems to know ol' "N5XXX" who "has the same transceiver and antenna I do only *his* talks farther than mine!" The difference could be in the antenna, or in the way it's mounted, or even be caused by something else on the vehicle. Let's review the practical considerations that affect transceiver performance.

Mounting the Antenna

The absolute best way to mount an antenna is to drill a hole in the center of the vehicle's roof and mount the antenna in it. Anything else is a compromise. Of course, some of you will always be squeamish about drilling a hole *anywhere* in your new car/truck/van/motor home, whatever you drive and, OK, I understand how you feel, so bring on the compromises.

If you drive a sedan, a trunk lip mount, centered on the rear of the vehicle, is the next best thing to a hole in the roof.

Magnetic and on-glass mounts are, nominally, equal in being less effective than a trunk lip mount, but the magnetic mount, if placed in the center of the roof, can be equal or better.

Mirror and gutter clip mounts tend to inspire inarticulate adjectives, like "Bleagh," but are fine if you have limited expectations. This also applies, generally, to mounting the antenna on a headache rack or luggage rail.

The Match

We all know that an antenna *must* be tuned. Do not allow the words "close enough" to pass your lips. If you don't have an in-line wattmeter or a good SWR bridge (rated for the frequency you're checking), then ask around and borrow one. Cut the whip *longer* than the chart indicates for your desired frequency and do your tuning on a frequency near the one you plan to use (so as not to interfere with anyone else while tuning). If you plan to use several frequencies, then add the highest to the lowest and divide by two to get your optimum tuning frequency. Whether you're using an in-line wattmeter to check reflected power or an SWR bridge, you want the lowest possible reading; remember that an SWR bridge must be recalibrated each time any change is made in the antenna or frequency. The vehicle must be in an open area with no trees, metal or people standing nearby. Get in the vehicle, close the doors, put your meter in line, get a reading, cut a "wee bit" off the whip, and check it again. If the meter reading isn't lower or is actually higher STOP: Skip to the section of this article labeled "Fix 'Ems", then start over with this section. If the meter reading was lower, then continue cutting and checking for as long as the meter reading continues to be lower. At the first sign of the slightest upward meter reading, STOP again: That's as good as it gets.

Other Stuff on the Vehicle

A nearby antenna on another frequency band can affect both the match and the pattern of radiation to and from the vehicle. An antenna *anywhere* on the vehicle tuned on or near the same band will act as a trap, adversely affecting the pattern of radiation, and possibly affecting the match.

Other objects on the vehicle, like a headache rack, light bar, or luggage rack, can also cause problems.

Surprise

With frequencies between 6 and 20 meters something really weird can happen.

Scenario: It checks near perfect with the meter but it doesn't work. With the meter out of the line, the S-meter drops to nothing and the transmitter barely works.

How come? A piece of coax that is exactly a quarter wave long, or an odd multiple of quarter waves long, at the frequency you're using, appears, to the transceiver, as a dead short. How long a quarter wave is depends on the coax because RF travels along a wire slower than it does in free space. This speed depends on the cable's velocity of propagation, which varies with the insulating materials used in its construction. The most appropriate response to this information is "who cares." Putting the meter in-line changes the length so everything works fine while you're checking it.

The Solution: Cut six to twelve inches off the coax. If you have no slack, it's better to change out the cable than to add a jumper. Either way, the fix is to *change* the cable length.

Fix 'Ems

A problem in the coaxial connector or the mount may or may not show up on the meter, but *will* degrade performance. If you're not an "experienced hand," the odds are against your having installed the coaxial connector properly. Get somebody to check it and, if he redoes it, watch. A bad center wire connection at the mount usually shows up on the meter, but a poor ground connection at the mount can destroy antenna performance *without* looking as bad on the meter. Check the mount's ground connection carefully; it may be necessary to scrape away the paint or a bit of rust or to dismantle and clean the mount itself. Clean the tough-looking stuff with a wire brush, steel wool, or very fine sandpaper. Clean and polish everything else with a pencil eraser or, my personal favorite, an old fashioned typewriter eraser, and don't forget to clean the antenna as well as carefully re-tensioning any compression or leaf contacts.

Transceiver power wiring can also affect performance. Even a 5 watt transceiver will most likely work better if its positive lead is run directly to the battery and its negative lead is securely attached to the vehicle chassis. Note: I'm assuming that we're dealing with a negative ground vehicle; reverse all this for positive ground *after* ascertaining that the transceiver is capable of operating with positive ground.

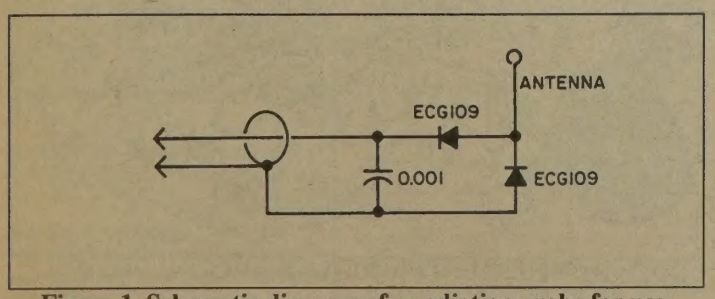

Figure 1. Schematic diagram of a radiation probe for use with a digital multimeter (DMM).

Relative Performance and Radiation Patterns

To compare the relative outputs of different antennas, different vehicles, or to acquire a graphic representation of a vehicle's radiation pattern, you need a relative field-strength meter and a method of accurately controlling distance. Controlling the distance can be done nicely with a piece of string. If you have a field-strength meter, skip ahead to the "Procedures" section; if not, you can easily build a radiation probe to use with your DVM/VOM.

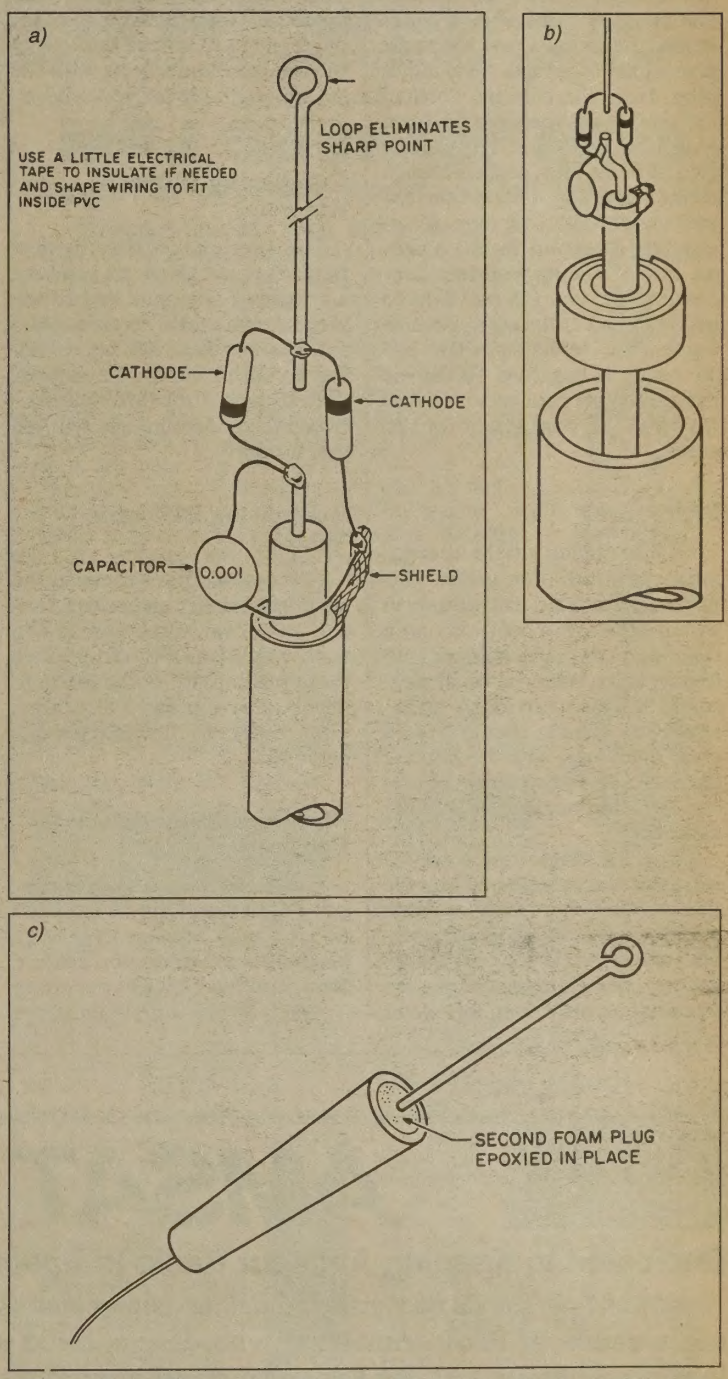

Figure 2 (a). Wiring details of the RF probe. (b). An inch below the components, wrap a piece of foam several times around the cable to form a round plug that will fit snugly inside the pipe. (c). Work the plug into the pipe until the components are three inches below the end of the pipe. Pour some epoxy inside the pipe to secure everything, then install a second plug and epoxy it in place just inside the end of the pipe.

Construction of the RF Probe

See the Parts List for materials and Figure 1 and 2 for construction details of the radiation probe. Connections are "flying," that is, no circuit board is required.

Assemble, solder, and shape components and wiring so the circuit will fit inside the PVC pipe. Slip the free end of the coax into and through the pipe, stopping a few inches from the components. An inch below the components, wrap a piece of foam several times around the cable to build up a round

plug that will fit snugly inside the pipe.

Use a pencil or a slender screwdriver to work the plug into the pipe until the components are three inches below the end of the pipe. Prop or clamp the pipe vertically, mix about two teaspoons of quick-setting epoxy and pour it into the pipe. This will bond the coax and foam to each other, and bond both to the pipe, making a secure strain relief. After the epoxy has had a few minutes to set, wrap the second piece of foam several times around the antenna, just above the pipe, again forming a snug-fitting plug. Hold the antenna vertical and rigid while you work the foam plug into and about 1/8" below the end of the pipe. Mix up enough additional epoxy to bond the antenna and plug to the pipe, forming a rigid support for the antenna. Attach the appropriate connectors for your DVM/VOM to the other end of the coax, observing that the shield is positive and the center is negative. To use the radiation probe, connect it to your DVM/VOM, configured for DC volts.

Procedures

Whether using a field-strength meter or a radiation probe, it is important to hold everything in exactly the same position, even standing in the same manner with respect to the antenna, for all measurements. As when tuning an antenna, the vehicle should be in a clear open area with the vehicle doors closed and no object or person standing nearby outside the vehicle.

To get the range, have someone sit inside the vehicle and key the transmitter (on a frequency that will not cause undue interference with others) while you very quickly move from a distance towards the vehicle, observing the meter to get some idea of the range of voltages to expect from your particular meter. Overheating the transceiver finals by prolonged transmission is undesirable, so get this done as quickly as possible and allow the transceiver to cool before continuing. Once you have learned the range of voltages you will encounter, select a distance, as far from the vehicle as possible, that will yield usable readings. Tie one end of a string around your meter or the handle of your probe, and make a tied loop of the other end to fit around the base of the antenna under test, with the string length set for your chosen distance.

Comparing Different Antennas

This procedure should by now be obvious, but given that you have a couple of antennas that fit the same mount and are trying to decide between them, just take a reading on both from the same position. If there's any difference between them the numbers will tell you instantly.

Comparing Different Vehicles

Alternately, park them in the same general spot and orient yourself in the same relationship to each vehicle and it will make a more meaningful comparison to check in two or more directions with respect to the vehicles orientation.

Plotting a Radiation Pattern

Find something to use as markers. I used a handful of red plastic wire nuts because they were handy, but anything you can see clearly will work. Get your string in place on the antenna and the meter in hand but don't key the transceiver yet. Walking around the vehicle in a circle, place at least 8 (12 is better) markers more or less equidistant around the vehicle. Using a nice clean sheet of paper, draw a simple little sketch of your vehicle with a bold dot indicating antenna placement. Put another dot, as accurately as possible, outside your sketch, showing the location of each marker and number them. Now take a meter reading, with the transmitter keyed, at each location and record your results by the number. Go to your sketch and draw a faint but visible pencil line extending from the antenna through each marker dot to the periphery of the page. You'll now have to decide on a scale, allowing for the space available on your drawing, and convert your meter readings to fractions of an inch or a convenient metric unit. My highest meter reading on my DVM was 63 millivolts so, for my scale, I used 1 centimeter = 1 millivolt.

Measuring from the antenna outward along each numbered radial line of your drawing, mark a point which corresponds to your measured field-strength voltage. Using curves, not sharp angles, connect your field-strength dots. That's all there is to it and you now have an accurate picture of your vehicle's radiation pattern. What good is it? In an emergency it can be helpful to know which way to point the vehicle for optimum transceiver performance or you may just simply want to find the best omnidirectional point on your vehicle.

I have a small pickup with a 2 meter quarter-wave antenna mounted at the rear center of the roof. Over my head, on the driver's side rear of the roof, I have a 450 MHz (commercial band) quarter-wave antenna which has an adverse affect on my pattern. The

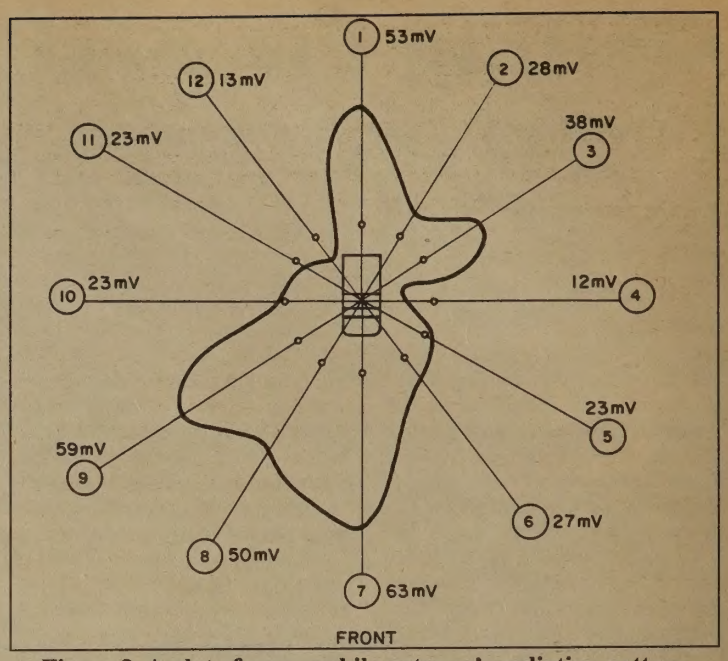

Figure 3. A plot of your mobile antenna's radiation pattern can be drawn by taking measurements with the RF probe at selected points around the vehicle.

AM/FM antenna on the right front fender (passenger side) apparently acted as a director, having a positive affect on my pattern in this direction. The transceiver is an older (as in ancient) 10-watt Heath.

After plotting my truck, I got curious about the pattern on the right rear side. Investigation showed nothing to affect it on the right, but the wiring harness for my Fiberglas camper shell's interior light comes up the left rear side.

I hope that you find some hours of educational entertainment as a result of this article and one or two of you may even get an "Aha!" out of it. Happy mobiling. RF

Parts List

5' (approx.)	Any variety of shielded cable that's flexible and not too large in gauge.
18" to 24"	3/4" PVC, any schedule, and condition.
1	15" to 20" antenna (use a coat hanger, #12 copper or just about anything. I used 19" of small-gauge stainless welding rod which cost me less than a nickel).
1	Small mica capacitor approximately, 0.001 µF.
2	"Little glass diodes" from the junk box (ECG109 or IN34A (Radio Shack #276-1123) if you're picky).
2	Strips of polyfoam, nominally 1/2" x 3/4", and between 6" and 12" in length.

A couple of connectors that mate your DVM/VOM input.

AMSAT

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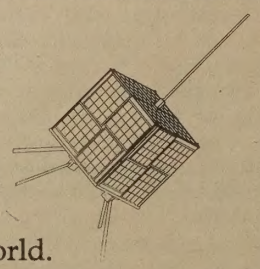

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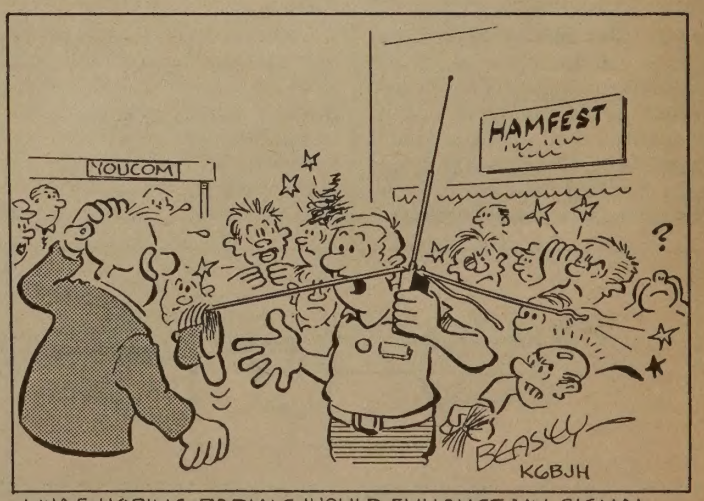
Updates

Shuttle to Space Center QSO

See the front cover of the June '92 issue of *Radio Fun*. The author's byline was inadvertantly left off of the article. Credit for this story should be given to Gene Marcus W3PM. RF



I WAS HOPING RADIALS WOULD ENHANCE MY SIGNAL

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editor/publisher
Wayne Green W2NSD/1
associate publisher
David Cassidy N1GPH

managing editor
Bill Brown WB8ELK
production editor
Hope Currier
editorial associates
Sue Jewell
Joyce Sawtelle
contributing editors
Mike Bryce WB8VGE
Michael Geier KB1UM
Carole Perry WB2MGP
Gordon West WB6NOA

advertising sales representatives
Dan Harper
Louise O'Sullivan
advertising coordinator
Sue Colbert

1–603–924-0058
1–800–274-7373
FAX (603) 924-9327

graphic design
Rachel Timper
desktop page make-up
Linda Drew,
Alice Scofield

circulation manager
Harvey Chandler

Wayne Green, Inc.
editorial offices
Radio Fun
70 Route 202-North
Peterborough, NH 03458
(603) 924-0058
FAX: (603) 924-9327

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letters

Write to: Radio Fun, 70 Route 202-N, Peterborough, NH 03458

Gene Stanley WA5PWP, Little Rock AR Why is amateur radio so boring to most of us nowadays? Have you ever tuned across the bands trying to find someone interesting to talk to? I come home and turn on the old HF rig, say 15 or 10 meters, call CQ or answer one or wait until a QSO is ending to call. Too many times it is just some old retired guy with nothing interesting to talk about except his recent fishing trip, etc. Would it not be far more interesting if you could, say, call CQ for another ham who is knowledgeable, say, in classical music? Or maybe French cooking, or whatever? Further, say I wanted to communicate with a specific ham, it would be great to have a system where you could enter their callsign, and if they are available get access to them.

I thought about how such a system could be built. I first thought about all those unused VHF/UHF repeaters across the country. That would not work because of time delays through several machines. My next idea was a satellite transponder.

There would be a need for a large number of channels for both voice and data, a need for a channel for a packet-like signal to "find" the person you are looking for, and a need to put as much control into software as possible, allowing us to upgrade more easily as computers get better. There must be enough computer type hams to write software. Equipment? How about all those old satellite systems people are selling in the newspaper? Or maybe some entrepreneur starting up a "ground station" kit?

To make it all work will require a national organization. The ARRL? Don't make me laugh. This idea is too forward-thinking for them. We are talking 21st century hamming. AMSAT? I don't know those folks. I can see the cost of putting and maintaining a bird as being high. It takes money—someone has to pay for it. How about those who use it the most? What about freeloaders? With a log-in, say with your callsign, a quick lookup via the computer could determine if you are valid. Everything should be computer-driven, probably from a master control ground station. We'd need backup control stations, too. Anyway, back to money. Some might view this as a super repeater in the sky, with coverage of the entire United States plus some of Canada (standard microwave footprint). How about a new national organization to fund and run this? I think voluntary dues like typical clubs are not the answer. It may have to be something more commercial (have to check the rules on that one).

I envision a system including an HT portable, communicating via UHF to a remote base at the house, which in turn connects to a microwave ground station; some form of computer control would be needed here. Control probably would be some form of packet up to the bird, then back down to the master ground station for processing of communications request, where a "link" would be made between two hams—either voice or data. Possible features:

Station active time (say 5 to 8 p.m.)

Call only certain stations (i.e. callsign specific)

Block certain calls

CQ specific areas of interest (i.e. French cooking)

Round-table discussions (I don't know if this one will work)

Emergency broadcasts (to all calls)

Possible later advancements could include video (ATV!). The degree of complexity would be up to the individual. Voice recognition and control certainly is possible.

What do you think? Will this be 21st century hamming? Maybe!

Gary Fantucci I would like to thank all the people out in the ham world for welcoming us new radio operators. I've had my license for three or four months now and haven't been on the air yet. I have been getting so much material through the mail, and *Radio Fun* is at the top of the list. I like old tube sets, and the article in this month's issue hit home. I picked up a radio (tube type) for $35, and it worked. I had three different people look at it and three times I had to get it running again.

Thanks to your advice, I know it's up to me to fix and operate according to my standards. Thank you.

Matt Parkin KC6ENB, Costa Mesa CA I was introduced to ham radio in the latter part of 1988 at an emergency fair conducted by the Church of Jesus Christ of Latter-day Saints in my area. I began meeting with a close family friend and ham, Mr. Rusick N6BNN, and learning what ham radio is about.

After completing the Novice requirements, I prepared and passed the Tech. I received my Novice ticket the following day in the mail. I began helping with volunteer communications for emergencies and special events. I feel like I am finally doing something good that others can benefit from as well as myself.

I am currently 20 years old and plan a career as an aviation pilot. My understanding of radio theory will be beneficial. I will be able to understand the navigation and communication equipment and uses much better and provide a basic explanation of why a radio may or may not be operating normally.

I am grateful to Mr. Rusick and the others who helped me to come this far. I am working at getting my family involved in this wonderful activity. I hope to be able to set up a ham club at one or more local schools in the near future.

Thanks for providing a source with sound advice for us young ones out there. May the enjoyment and QSOs continue!

Ted Myren VE3OTQ, Sault Ste. Marie, Ontario In the last few months, several of the local "no-code" licensees (myself included) have made the leap

Continued on page 30

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MFJ-949D is the world's most popular 300 watt PEP tuner. It covers 1.8-30 MHz, gives you a new peak and average reading Cross-Needle SWR/Wattmeter, built-in dummy load, 6 position antenna switch and 4:1 balun -- in a compact 10 x 3 x 7 inch cabinet. Meter lamp uses 12 VDC or 110 VAC with MFJ-1312, $12.95.

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MFJ Multiple DC Outlet

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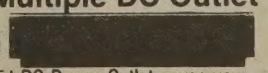

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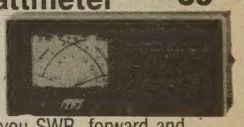

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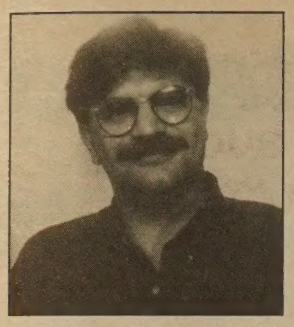

computers in the shack

by Jeffrey Sloman N1EWO

Hello, and welcome to "Computers in the Shack," a monthly column exploring the possiblities of ham radio and personal computers. Today, computers have the status that ham radio enjoyed 20 years ago—the premier technical hobby. Some of us know the fun and excitement of combining the two, making both more interesting.

One of the ways computers are used in ham radio is as data terminals. Without question, the most common digital mode in ham radio is packet. Digital modes are those methods of transmitting information that, at their base, concern nothing more than an "on" or "off" signal. Technically, CW using the Morse code is a digital mode. Usually, though, when we think of digital radio, things like RTTY (Radio Teletype), AMTOR (Amateur Teletype Over Radio), and packet come to mind. For the next few months we'll take a look at packet radio—on both the VHF and HF bands—and how you can get started enjoying what it has to offer.

Packet Radio

One of the exciting possibilities for new amateurs—especially no-code techs—is the low-cost, high-tech world of packet radio. If you already own a computer and a handheld, less than $200 will get you what you need to participate in the global digital network. Even if you don't have a computer, readily available surplus "dumb" terminals will get you connected cheap (often under $50).

Even with a 5W handheld, the amateur packet network is a gateway to the world. Your small investment puts you in the driver's seat of a shack worth virtually millions. From HF across the ocean, to satellites in space, it's all available to any amateur packet station on 2 meters. Packet also brings you news and views about amateur radio. ARRL bulletins, NTS traffic, AMSAT info—and yes—opinionated loudmouths, can all be found on your local packet BBS (PBBS). The services available through 2 meter packet are impressive:

- •AMTOR Gateways—Reliable overseas communications to hams worldwide.
- •PACSATS—Satellites that have built-in PBBSs, reachable directly, too.
- •Space Vehicles—Talk direct to astronauts and cosmonauts.
- •NTS Network—Send messages to non-hams via the National Traffic System.
- •Internet Gateway—Access the Internet and send mail anywhere it goes.
- •Emergency Communications—Help out in disasters and other emergencies.

And, for those of you who want to volunteer, packet is a great way to get handicapped people into amateur radio. Adaptive technology that lets a person use a computer gets them going on packet right away.

A Quick Start

As I said at the beginning of this article, getting started in packet radio is easy—and cheap. Many of you will already have most of what you need. Let's take a look at the parts of a packet station.

Data Terminal

This is the keyboard and display that acts as your interface to the packet station. It is the equivalent of the mike and speaker of a phone station. The most obvious data terminal is a computer, common among hams today. Nearly any computer will do—from your old C64 to that brand-new 486/33. If you are going to use a computer, it needs two things. First, you need a place to connect the packet interface (TNC—or Terminal Node Controller). On a PC or Mac, this will be a serial port. Those of you with C64s can get TNCs designed to connect directly to your computer. Second, you will need some sort of communications software. While there are special packet terminal programs, all you really need is something that can talk to the COM port of your machine. If you are already using a modem, the software you have for that will work fine. Once you get going, you may want to experiment with one—or several—of the shareware offerings designed for packet that can be found on land-line BBSs, or one of the commercial packages offered by packet hardware manufacturers.

TNC (Terminal Node Controller)

The TNC is the equivalent of the modem you use to talk to land-line BBSs, plus it has some smarts built in to handle the special AX.25 protocol that packet uses. TNCs range from simple, inexpensive units—all you need to get started—to monsters that do everything imaginable and have DSPs (Digital Signal Processors) built in. A simple, used TNC can be found at hamfests for as little as $35; for a new one, expect to lay out about $100. If you are involved in HF, a fancier unit capable of HF operation may be a worthwhile investment.

Radio

That handheld you use to talk to your buddies on the local repeater is a great way to get started in packet. Since packet allows almost any station to repeat your signal, even the rubber duck may get you reliable packet operation. Sometimes a handheld can be a little ornery about getting interfaced to the TNC. Handhelds often use fancy PTT (Push To Talk) circuits that require careful wiring to get going. This is certainly only a tiny obstacle; you are almost certain to find someone locally who has already done it. Older radios can make good packet stations, too. Keep in mind, though, that some of these older rigs have slow switchover times between transmit and receive. This can give a TNC fits. All is not lost, though, since there are parameters on the TNC that can be set to compensate for this. Again, look for a local packet elmer to help you out—you are sure to find one.

Most packet operations happen on the lower end of 2 meters. The frequencies that you will find active vary from place to place. If you can't find anyone who can tell you what frequencies to try in your area, listen to the ones in Table 1. If you hear short buzzing bursts, you've found some packet activity.

As you can see, a little cash—and a little persistence—will get you on the air. Packet can be a lot of fun. It is different than other forms of amateur communications because—thanks to the packet BBS—it doesn't all happen in real-time. While many hams really enjoy keyboard-to-keyboard QSOs, PBBSs give you the opportunity to sit back, relax, and talk to friends worldwide at your own pace.

What's Inside

While you don't need to know what goes on inside a TNC to use packet radio, having some idea can help you troubleshoot problems that arise. Besides, hams are a technical bunch, and the spirit of amateur radio is experimentation. One note, though. TNCs have many settable parameters. Many of these determine the behavior of the TNC on the LAN (Local Area Network). Yes, that's right, your TNC is a node on a LAN. If you use a LAN at work, then you know how difficult it can be to keep running sometimes—even with one system administrator. On the AX.25 packet LAN, you are the administrator of your node. If you don't understand what a parameter does, ask someone who knows before you change it. Some of these parameters look like they would improve the performance of your node when, in fact, changing them will cause everyone on the LAN trouble. With that in mind, let's take a simple look at the guts of packet radio.

From Here To There

Packet communications takes place on two levels: physical and logical. The physical level is where the electrical signals are created, translated, and transmitted. The signal is received where the process is reversed. The logical level is where the packets are assembled—on the transmit side. On the receive side, the packets are checked for errors, and then disassembled into the data that is read or stored.

TNCs have two basic functional parts: a PAD (Packet Assembler/Disassembler) and a modem—very much like the modem you use on phone lines.

The physical level is where the modem comes in. Just as a telephone modem turns digital signals into analog—for transmission over phone lines—a radio modem turns the bits and bytes of data into sounds that can be transmitted over the air. This is necessary because the digital signal itself cannot be transmitted over a conventional radio link. By converting the data into sound, FM transceivers can be used.

Most TNCs have modems that operate at 1200 baud. This means that they can transmit a signal that makes 1200 transitions each second. This is not necessarily the same as 1200 bits per second as many assume. In this case, it probably is, but fancy modulation techniques that use the phase of the signal can pack more bits per transition into the signal. In fact, the data rate, another spec that refers to how many characters per second of user information cross the link, will be much lower due to protocol overhead.

As anyone who has spent any time talking on 2 meters knows, many forms of interference—both natural and man-made—are possible. Because FM radio will almost always be a noisy channel, some sort of error detection and correction is needed. It is also very hard to have a QSO without some set of rules that everyone understands. This is where the logical level stuff comes in. Packet radio uses a protocol called AX.25, or Amateur X.25. A protocol is an agreed upon set of rules for talking—in this case digitally—between stations. It is not much different from the protocol that we use to insure smooth voice repeater operation. For example: inserting your callsign into a gap in the conversation to

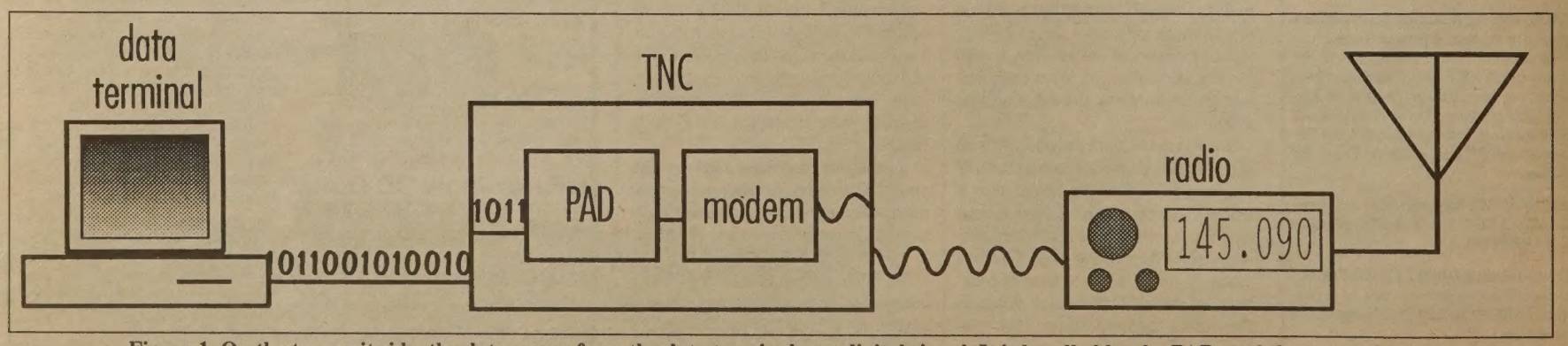

Figure 1. On the transmit side, the data comes from the data terminal as a digital signal. It is handled by the PAD, and then passed to the modem where it is converted to audio. The audio is then sent to the radio transmitter. Receiving is exactly reverse.

signal that you need the frequency or, more clearly, the rules that are followed during a controlled net.

The AX.25 protocol provides the rules that the TNC needs to act as a PAD, or Packet Assembler/Disassembler. AX.25 describes exactly what the TNC should expect when a packet is received. The protocol describes several different types of packets (really called frames). Each type of frame has a special function. For example, one type—the connect frame—is used to establish the connection, just as the name implies. Its complement, the disconnect frame, does just the opposite. Once the link is established, a set of various frames are responsible for link maintenance. Those of you who are interested in the gritty details of AX.25 can get a publication from the ARRL describing the standard in detail.

The TNC's job as PAD involves packaging the user's data into another type of frame—the data frame. This frame is the meat of a packet connection. As with all frames, the data frame starts with a header. The header includes vital information such as the sender, the recipient, and up to seven intervening digipeaters. *[Note: A digipeater (for DIGItal rePEATER, and often called a "digi") can be any station. It requires no special hardware beyond what it takes to be a packet station. Unlike voice repeaters, digipeaters operate in simplex mode. That is, the digipeater receives the packet destined for the next station, stores it temporarily, and then retransmits it. The digi notes that it handled the packet in the header. The AX.25 protocol requires that each digi handle the packet in the order specified in the header, even if the recipient can hear the original transmission.]*

The TNC also calculates a checksum. A checksum is the result of a mathematical operation on the frame. This checksum is the heart of the error detection and correction built into AX.25. The receiving TNC performs a checksum of its own, and then compares the result to the sending station's. If they do not match, it indicates that the data did not arrive intact. Having detected the error, the receiving TNC sends a special frame requesting retransmission of the offending packet. This is the error correction.

So, the TNC is responsible for establishing and maintaining the link, and for handling the user data that is passed across it. In the world of ham packet radio, AX.25 is not the only protocol used—though it is clearly the most common. Another protocol that you will find on amateur frequencies is called TCP/IP (Transport Control Protocol/Internet Protocol). TCP/IP was developed for Internet—an enormous network of industrial, educational, and governmental computers. In many ways, TCP/IP is more advanced than AX.25 but, in order to use it, software external to the TNC must be run. The TNC is put into KISS (Keep It Simple, Stupid.) mode. That is, the TNC simply passes the data on without trying to use the AX.25 protocol. If you think that you might be interested in TCP/IP, be sure to buy a TNC that supports KISS mode.

Conclusion

Packet radio is a great way to keep up on what's happening out in the amateur community. It has opportunities for experimentation, and a way for the no-code technician to communicate with amateurs all over the world. Next month we'll take a look at what's involved in actually putting together the hardware of a packet station. If you have any questions concerning this column, packet radio, or the possibilities for computers in the shack, write to me here at *Radio Fun*—I look forward to hearing from you. 73 de N1EWO. RF

145.010
145.030
145.050
145.070
145.090

Table 1. The most common 2 meter packet frequencies.

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TH-27A	2M 2-5W MICRO 40ME	419.95	CALL
TH-47A	70CM 2-5W MICRO	429.95	CALL
TH-415	70CM 2W SCANNG DEL	419.95	CALL
TH-77A	2M/70CM DEL DUAL B	599.95	CALL

MOBILE VHF/UHF

MODEL	DESCRIPTION	LIST	OURS
TM-241A	2M 45W PROG MIC	469.95	CALL
TM-331A	220MHZ 25W PROG MIC	469.95	CALL
TM-441A	440MHZ 25W PROG MIC	479.95	CALL
TM-631A	2M/220MHZ DUAL BAND	749.95	LMTD CALL
TM-791A	2M/70CM/? TRIBANDER	849.95	CALL
TM-741A	2M/70CM/? TRIBANDER	849.95	CALL
TM-941	2M/440M/1.2 TRI-BAN	1199.95	CALL
TM-751A	2M 25W ALL-MODE	699.95	CALL
TS-711A	2M 25W ALLMODE BASE	1059.95	CALL
TS-790A	2M/70CM SATELLITE	1999.95	CALL

HF EQUIPMENT

MODEL	DESCRIPTION	LIST	OURS
TS-140S	HF COMP GEN COV	949.95	CALL
TS-690S	HF/6M COMP GEN COV	1549.95	CALL
TS-450S	HF DELUXE COMP	1349.95	CALL
TS-450S/AT	HFDEL COMP TUNR	1549.95	CALL
TS-850S	HF 12V DEL DDS	1699.95	CALL
TS-850/AT	HF 12V DEL TUNR	1899.95	CALL
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IC-2GAT	2M 7W 15MEM DTMF	429.00	CALL
IC-2SAT	2M 2-5W DEL MICRO	439.00	CALL
IC-2SRA	2M/SCANNER HT	599.00	CALL
IC-24AT	2M/70CM DEL MICRO	499.95	CALL
IC-3SAT	220M 2-5W MICRO	449.00	CALL
IC-4SAT	70CM 2-5W MICRO	449.00	CALL
IC-4SRA	70CM/SCANNER HT	599.00	CALL
IC-4GAT	70CM 7W 15MEM DTMF	449.00	CALL
IC-W2A	2M/70CM DUAL MICRO	629.00	CALL

MOBILE VHF/UHF

MODEL	DESCRIPTION	LIST	OURS!
IC-229A	2M FM, 25W 20MEM	449.00	CALL
IC-229H	2M FM, 45W 20MEM	479.00	CALL
IC-3220A	2M/70CM 25W 40MEM	659.00	CALL
IC-3220H	2M/70CM 45W 40MEM	699.00	CALL
IC-2410	2M/70CM 45W DEL.	TBA	CALL

HF EQUIPMENT

MODEL	DESCRIPTION	LIST	OURS!
IC-725	HF COMPACT GEN COV	949.00	CALL
IC-726	HF/6M COMP GEN COV	1299.00	CALL
IC-735	HF DELUXE COMPACT	1149.00	CALL
IC-751A	HF 12V BASE TXCR	1699.00	CALL
IC-765	HF DELUXE TNR,PS	3149.00	CALL
IC-781	HF DX'ERS DELIGHT	6149.00	CALL

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FT-411E	2M 2-5W 50MEM,CTCSS	405.00	CALL
FT-811	70CM 2-5W 50MEM	405.00	CALL
FT-470	2M/70CM 2-5W 50MEM	491.00	CALL
FT-26	2M-5W WITH/DTMS PAGING	349.00	CALL
FT-76	440MHz-5W WITH/DTMS PAGING	359.00	CALL

MOBILE VHF/UHF

MODEL	DESCRIPTION	LIST	OURS
FT-290RII	2M 25W ALL-MODE	610.00	CALL
FT-690RII	6M 10W ALL-MODE	752.00	CALL
FT-736R	2M/70CM 220//1.2 SAT	1922.00	CALL
FT-5200	2M/70CM DUAL BAND	749.00	CALL
FT-6200	70CM/1.2 DUAL BAND	899.00	CALL
FT-2400H	2M 50W,LCD,CTCSS	419.00	CALL

HF EQUIPMENT

MODEL	DESCRIPTION	LIST	OURS
FT-747GX	HF LGTWGT MOBILE	889.00	CALL
FT757GXII	HF COMP GEN COV	1089.00	CALL
FT-767GX	HF 2//220//70C TUNR	2299.00	CALL
FT-990	HF 12V DEL TUNR+	2399.00	CALL
FT-1000B	HF BASIC VERSION	3399.00	CALL
FT-1000D	HF QSL CATCHER!!	4399.00	CALL

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PARAGON	HF GEN COV TXCVR	2245.00	CALL

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Front Panel Graphics

Make your next project as pretty as it is functional.

by Mike Gray N8KDD

Among the many ways to label and illustrate the front panel of an electronics project, silk-screen is probably the most attractive. Unfortunately, silk-screen is best suited for high volume production, not for prototype or hobbyist applications. What we experimenters need is a method that produces results resembling screened graphics, without the mess or expense.

Laminate

I have been using polished aluminum plate in my projects for some time. I label the panel with dry transfer lettering and apply a coat of clear lacquer over it to prevent the fragile lettering from being scraped off.

This method, while relatively fast, is slower and less durable than the plastic laminate method described below.

Adhesive-backed, clear plastic laminating sheet is available in most office supply stores. It comes in 9" x 12" sheets, with a glossy or satin finish. You could apply the sheet over dry transfer lettering, but it won't look very good because the sheet doesn't conform well around the lettering, leaving unsightly air bubbles. The sheet adheres very well to a flat surface (like aluminum) and it hides surface scratches. The sheet makes a good finish, but how do you get the artwork onto it?

You can create the graphics for your panel in pencil, pen, or dry transfers on a sheet of white graph paper with blue lines. When you photocopy your artwork, the blue lines won't appear. Another method is to use a computer drafting or drawing program to create the artwork.

Make a photocopy of the finished artwork. You may need to experiment with the photocopy machine. Some copiers allow darker or lighter, smaller or larger copies than the original. The purpose of making a copy on paper is to preserve the original and darken any light areas such as pencil lines.

The Finished Product

Cut a sheet of laminate to exactly 8.5" x 11". Use a paper cutter if you can, rather than scissors. Place the laminate plastic-side-down in the paper hopper of the copier. It pays to experiment here: Some machines copy on the top side of the sheet. Ask the owner of the copier first before you run a sheet of plastic through the machine. The copiers I've used are capable of making "flimsies," or transparencies, and laminating sheet is of similar material. If the owner objects at first, point out the fact that the two are nearly identical and it has been done before.

Place the copy of your original artwork in the machine and copy it onto the laminate. Copier toner sticks pretty well to the laminating sheet, but it can be scraped off rather easily when it first comes out of the warm copier. Handle the sheet carefully until it cools.

Spray a fine mist of clear lacquer over the laminate. If you use too much on the first coat it will dissolve the toner. The solvents in the lacquer spray will impregnate the toner and cause your graphics to rise and flow slightly, giving it the look and feel of a silk-screened print.

You can apply the laminate over bare aluminum or a smooth painted surface. If you choose to paint the panel, make sure the paint is dry before installing the graphic laminate. After you have the sheet in place, rub out any air pockets and spray on another light coat of lacquer.

If you want to see what it looks like before you try it, I can send you a sample sheet of radio-oriented words, phrases and pictures for $3 (Mike Gray N8KDD, 465 W. Maple Rd., Milford MI 48381). Just cut them out and stick them on your project! RF

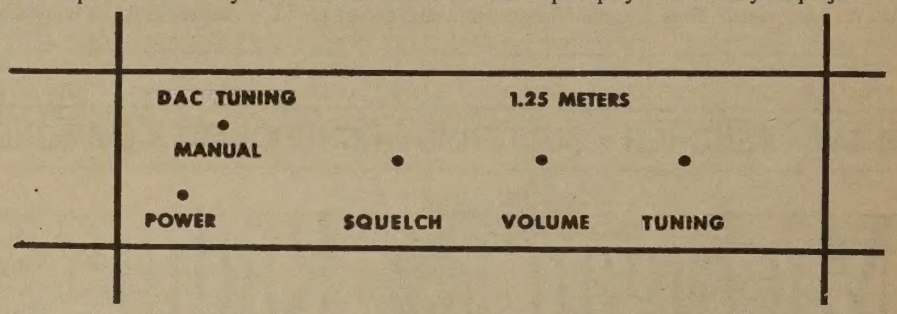

Figure 1. An example of front-panel graphics using toner on self-adhesive laminate.

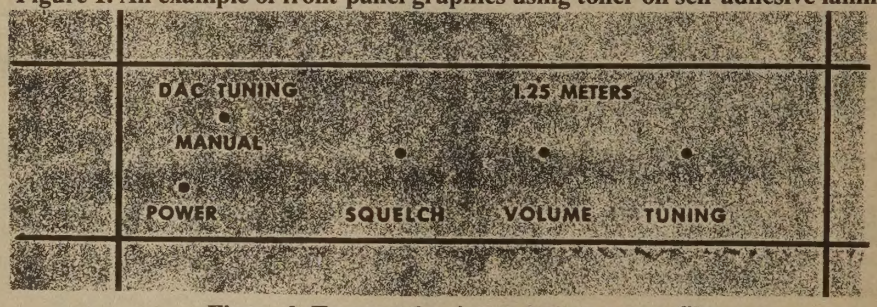

Figure 2. Toner and paint on transparency film.
(This method was published in *Midnight Engineering*, May 1992.)

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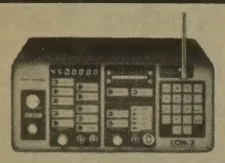
CIRCLE 101 ON READER SERVICE CARD

RAMSEY ELECTRONICS



COM-3
$279.00

2 WAY RADIO SERVICE MONITOR

COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantatic price—and our new lease program allows you to own a COM-3 for less than $3.00 a day. Features •Direct entry keyboard with programmable memory •Audio & transmitter frequency counter •LED bar graph frequency/error deviation display •0.1–10.000 µV output levels •High receive sensitivity, less than 5 µV •100 kHz to 999.9995 MHz •Continuous frequency coverage •Transmit protection, up to 100 watts •CTS tone encoder, 1 kHz and external modulation.

RSG-10
$249.00

SYNTHESIZED SIGNAL GENERATOR

Finally, a low-cost lab quality signal generator—a true alternative to the $7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than $3.00 a day. Features •100 kHz to 999 MHz •100 Hz resolution to 500 MHz, 200 Hz above • −130 to +10 dBm output range •0.1 dB output resolution •AM and FM modulation •20 programmable memories •Output selection in volts, dB, dBm with instant conversion between units •RF output reverse power protected •LED display of all parameters—no analog guesswork!

FREQUENCY COUNTERS

CT-70 7 DIGIT 525 MHz | **CT-90 9 DIGIT 600 MHz** | **CT-125 9 DIGIT 1.2 GHz**

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated-thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

NEW CT-250 2.5 GHZ

ACCESSORIES FOR COUNTERS

Telescopic ship antenna—BNC plug, WA-10	$11.95
High impedance probe, light loading, HP-1	$16.95
Low-pass probe, audio use, LP-1	$16.95
Direct probe, general purpose use, DC-1	$16.95
Tilt bail, elevates counter for easy viewing, TB-70	$ 9.95
Rechargeable internal battery pack, BP-4	$ 8.95
CT-90 oven timebase, 0.1 ppm accuracy, OV-1	59.95

ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	20 Hz–600 MHz	< 25 mV to 500 MHz	8	1 Hz, 10 Hz	$189.95
CT-70	20 Hz–550 MHz	< 50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	$139.95
CT-90	10 Hz–600 MHz	< 10 mV to 150 MHz < 150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	$169.95
CT-125	10 Hz–1.25 GHz	< 25mV to 50 MHz < 15 mV to 500 MHz < 100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$189.95
CT-250	10 Hz–2.5 GHz typically 3.0 GHz	< 25 mV to 50 MHz < 10 mV to 1 GHz < 50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	$249.95
PS10B Prescaler	10 MHz–1.5 GHz, divide by 1000	< 50 mV	Convert your existing counter to 1.5 GHz		$89.95

SPEED RADAR $89.95 complete kit SG-7

New low-cost microwave Doppler radar kit "clocks" cars, planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second! Earphone output allows for listening to actual doppler shift. Uses two 1-lb coffee cans for antenna (not included) and runs on 12 VDC. Easy to build—all microwave circuitry is PC stripline. ABS plastic case with speedy graphics for a professional look. A very useful and full-of-fun kit.

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 1000 MHz. 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC.
PR-2, wired, includes AC adapter $59.95

2M POWER AMP

Easy to build power amp has 8 times power gain, 1W in, 8W out, 2W in, 16W out, 5W is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.
PA-1, 40W pwr amp kit $34.95
TR-1, RF sensed T-R relay kit $11.95

FM WIRELESS MIKE KITS

FM-3 SHOWN

Pick the unit that's right for you. All units transmit stable signal in 88-108 MHz FM band up to 300' except for hi power FM-4 that goes up to 1/2 mile.
FM-1, basic unit $5.95
FM-2, as above but with added mike preamp $7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 10' away $14.95
MC-1, miniature sensitive mike cartridge for FM-1,2,4 ..... $2.95

MICROWAVE INTRUSION ALARM

A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC.
Complete kit MD-3 . $19.95

MUSIC MACHINE

Neat kit that will produce 25 different classical and popular tunes, plus 3 doorchime sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.
Complete kit, MM-5 ..... $24.95
Case + knob set, CMM-5 . $12.95

PACKET RADIO

Two new versions are available for the Commodore 64 (P-64A) or the IBM-PC (P-IBM). Easy assembly "NO TUNING". Includes FREE disk software, PC Board and Full Documentation.

KIT	P-64A	$59.95
	P-IBM	$59.95
CASE	CPK	$12.95

LO NOISE PREAMPS

Make that reciever come ALIVE! Small size for easy installation with Hi-Q tuned input for peak performance. Excellent gain and noise figure—guaranteed to improve reception! Specify band: 2M—PR-10, 220 MHz—PR-20, 440 MHz—PR-40.
Each kit $17.95

TONE DECODER

A complete tone decoder on a single PC board. Features: 400–5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 $6.95

VOICE ACTIVATED SWITCH

Voice activated switch kit provides switched output with current capability up to 100 mA. Can drive relays, lights, LED, or even a tape recorder motor. Runs on 9 VDC.
VS-1 kit. $6.95

TELEPHONE TRANSMITTER

Mini-sized with professional performance. Self-powered from phone line, transmits in FM broadcast band up to ¼ mile. Installs easily anywhere on phone line or inside phone!
PB-1 kit $14.95

NEW

SPEAKER PHONE

Talk on the phone hands-free, great to put in shop or shack, press the button to answer—no actual phone needed. Works same as commercial units. Talk from anywhere in room, phone line powered—no battery needed. Super for family and conference calls or buy two for hands-free intercom! Add our case set for a pro look.
SP-1 ..... $29.95 Case-CSP $12.95

TICKLE STIK

A shocking kit! Blinking LED attracts victims to pick up innocent-looking can—you watch the fun! Ideal for office desks, parties, nosey know-it-alls!
TS-4 kit $9.95

LIGHT BEAM COMMUNICATORS

Transmits audio over infrared beam up to 30'—use simple lenses to go up to ¼ mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug." Transmitter + receiver set, LB56 . . $19.95

FM RADIO

Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Std. FM broadcast band as well as large portions on each end. Ideal for "bug" receiver, hobby experiments or even as FM radio!
FR-1 kit $19.95

SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 8–45 ohm speaker.
BN-9 kit $6.95

BROADBAND PREAMP

Very popular sensitive all-purpose preamp, ideal for scanner, TVs, VHF/UHF rigs, counters. Lo noise, 20 dB gain, 100 kHz–1 GHz, 9V–12 VDC operation.
SA-7 kit $14.95

•2 METERS •223 MHz •440 MHz

$149.95

FANTASTIC FM TRANSCEIVERS

SYNTHESIZED—NO CRYSTALS

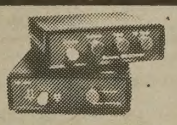
Ramsey breaks the price barrier on FM rigs! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeteers really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? . . . . No problem. Twelve diode programmed channels, 5W RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-146 kit (2 Meters)	$149.95
FX-223 kit (1¼ Meters)	$149.95
FX-440 kit (3/4 Meters)	$169.95
CFX matching case set	$ 24.95

2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quieting while the low noise preamp remarkably improves reception. Ramsey Electronics has sold thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.
PA-10 2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested $89.95
PA-20 220 MHz POWER BOOSTER (8 X power gain)
Fully wired & tested $89.95

QRP TRANSMITTERS HAM RECEIVERS



20, 30, 40, 80M CW TRANSMITTERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a $30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have two-position variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.
Your choice of bands $29.95
(Specify band: QRP-20, 30, 40 or 80)
Matching case & knob set, CQRP $12.95

20, 30, 40, 80M All Mode RECEIVERS

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in *QST* and ARRL handbooks. Very sensitive varactor tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Very EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.
Your choice of bands $29.95
(Specify band: HR-20, HR-30, HR-40, HR-80)
Matching case & knob set, CHR $12.95

E-Z KEY CMOS KEYER

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.
CW-7 kit $24.95
Matching case knob set, CCW $12.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!
AA-7 Kit $24.95
Matching case & knob set, CAA $12.95

SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to descramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
SS-7 kit $29.95
Matching case & knob set, CSS $12.95

SHORTWAVE RECEIVER

Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4–11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3–22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!
Shortwave receiver kit, SRI $29.95
Shortwave converter kit, SCI $27.95
Matching case set for SRI, CSR $12.95
Matching case set for SCI,CSC $12.95

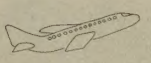
2, 6, 10 MTR, 220 FM RECEIVERS

Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth varactor tuning, dual conversion with ceramic IF filters, AFC, adjustable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rigs! For a complete finished pro look, add our matching case and knob set with screened graphics.
FM communications receiver kit $29.95
Specify band: FR 146 (2m), FR6 (6m), FR10 (10m), FR-220 (220 MHz)
Matching case & knob set, CFR $12.95

FM STEREO TRANSMITTER

Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!
FM-10 kit $29.95
Matching case set, CFM $12.95

AIRCRAFT RCVR



Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110–136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.
AR-1 kit $24.95
Matching case set, CAR $12.95

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FAX 716-924-4555

RAMSEY ELECTRONICS, INC. 793 Canning Parkway, Victor, NY 14564

CIRCLE 34 ON READER SERVICE CARD

try something new

Continued from page 13

timer PC board. With the values as shown in Figure 1, you can adjust the timer to turn the beeper on for a few seconds every 10 minutes or so.

You can also use the timer to periodically turn on and off just about anything as long as it doesn't draw more than 2 amps of current. Just hook up your device's power supply to the "COM" point and hook up the power lead of the device you wish to control to either the "NO" or the "NC" points.

You can use the relay to switch various signals as well (such as audio or video). This circuit was originally designed to switch in a computer video screen every ten minutes to identify an ATV (Amateur Television) repeater.

To vary the on/off times, you can use a different value for capacitor C3. For example, a value of 22 or 33 µF will give you about 2.5 minutes between relay transitions. To set up the on/off ratio initially, use a capacitor that is 10 times less than you final intended value. That way you can make your adjustments to potentiometers R5 and R6 without having to wait a full 10 minutes. Then just multiply the on/off times you obtain by 10 to find out the final setup using the larger capacitor.

There are spaces for two different kinds of relays on the board (only one relay is necessary). I prefer the Aromat relay since it draws less current. This circuit will drive both relays, however, if you'd like to control more than one device.

RF

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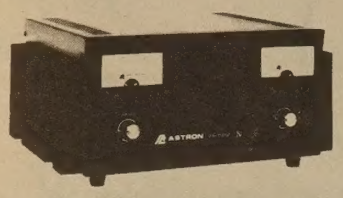


MODEL VS-50M

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• LOW PROFILE POWER SUPPLY						
SL-11A	•	•	7	11	2¾ x 7⅝ x 9¾	11

RS-L SERIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE				
RS-4L	3	4	3½ x 6⅛ x 7¼	6
RS-5L	4	5	3½ x 6⅛ x 7¼	7

RM SERIES MODEL RM-35M

• 19" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5¼ × 19 × 8¼	16
RM-35A	25	35	5¼ × 19 × 12½	38
RM-50A	37	50	5¼ × 19 × 12½	50
RM-60A	50	55	7 × 19 × 12½	60
• Separate Volt and Amp Meters				
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50
RM-60M	50	55	7 × 19 × 12½	60

RS-A SERIES

MODEL RS-7A

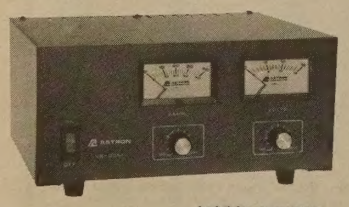
MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A		•	2.5	3	3 × 4¾ × 5¾	4
RS-4A	•	•	3	4	3¾ × 6½ × 9	5
RS-5A		•	4	5	3½ × 6⅛ × 7¼	7
RS-7A	•	•	5	7	3¾ × 6½ × 9	9
RS-7B	•	•	5	7	4 × 7½ × 10¾	10
RS-10A	•	•	7.5	10	4 × 7½ × 10¾	11
RS-12A	•	•	9	12	4½ × 8 × 9	13
RS-12B		•	9	12	4 × 7½ × 10¾	13
RS-20A	•	•	16	20	5 × 9 × 10½	18
RS-35A	•	•	25	35	5 × 11 × 11	27
RS-50A	•		37	50	6 × 13¾ × 11	46

RS-M SERIES

MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES



MODEL VS-35M

• Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Colors Gray	Colors Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	•	•	5	7	4 × 7½ × 10¾	10
RS-10S	•	•	7.5	10	4 × 7½ × 10¾	12
RS-12S	•	•	9	12	4½ × 8 × 9	13
RS-20S	•	•	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

International Environmental Radio Network

Continued from page 1

to answer questions, establish a global information clearinghouse, a computer databank, a global crisis-alert network—the idea is to build an international community of operators and provide environmental information from all over the world.

Here's how to get hooked in: The network happens every first and third Saturday on 14.330 mHz at 18:30 UTC, net control by Bob K3SRO; at 16:30 UTC, net control by Peter EI4GV/ON9CGV. Or, contact PLA/NET, 19 Glen Road, Lansdale PA 19446-1405; (215) 822-7474.

TNX Garbage, May/June 1992.

Satellite FM Repeater On Air

Within the last few days, AMSAT-DL announced that it has turned on the experimental FM voice repeater aboard AMSAT-OSCAR 21 (also known as satellite RS-14). The uplink frequency is 435.016 MHz and the downlink is 145.987 MHz, both plus/minus the Doppler shift. The FM repeater is enabled during the first four minutes of each ten-minute period, e.g., from 0000 to 0004, then from 0010 to 0014, etc., with the remaining six minutes used for telemetry and data transmission.

Through the AO-21 FM repeater I had a solid three-way QSO on May 25 with Bob W5GEL, in Corpus Cristi, Texas and Derrell WSØH, in St. Paul, Minnesota, and also heard N2AAM working WSØH before the repeater switched off at 1354 UTC.

AO-21/RS-14, a joint project of AMSAT-DL and a Russian group, was launched into a 600-mile-high polar orbit in 1991 as an experiment aboard a Russian GEOS spacecraft. It also carries two linear transponders for SSB/CW use (435.022-435.102 uplink / 145.932-145.852 downlink and 435.043-435.123 uplink / 145.946-145.866 downlink) and a RUDAK packet data transponder which shares uplink and downlink frequencies with the FM voice experiment. RUDAK cannot be accessed with standard amateur packet stations but requires specialized equipment similar to that used for capturing AO-13 telemetry. As it is primarily a developmental spacecraft, the transponders in use change frequently; schedule changes (when they are made) are announced by AMSAL-DL over the packet network and digital satellites. AMSAT North America carries Keplerian tracking data for AO-21 and repeats the AMSAT-DL schedule announcements, as they are received, over the AMSAT News Service, carried on most U.S. packet bulletin boards. *TNX to Ray Soifer W2RS.*

upgrade don't stop now

by Gordon West WB6NOA

Ask the Experts

Be sure to attend the upcoming large weekend hamfest in your area. A big hamfest will help you upgrade your operating skills, and allow you to meet the experts behind the ham radio equipment and accessories on display.

And when I say attend a LARGE hamfest, I specifically mean attend a hamfest where prominent equipment manufacturers like Kenwood, Yaesu, ICOM, Alinco, Ten-Tec, and Standard have factory personnel on hand. Even the "semi-large" hamfests will have local dealers with technical personnel on hand to answer some of those equipment or accessory questions you may have.

"At the Spokane, Washington, hamfest last April, I had a chance to meet with the experts at AEA," comments Linda Davis N6VHY, a recent upgrade student. "I learned more in an hour with the AEA personnel than I could have ever received out of a visit to a local store," adds Davis. This makes sense—equipment stores are in business to sell equipment, and may not have the time or personnel to spend up to an hour educating a recent packet buyer how to hook up their new system. But at the hamfest, big manufacturers don't sell the equipment themselves out of their manufacturer display booth; they are there specifically to teach the hams all about their particular brand of gear.

Roger Wyman of Standard Radio comments, "I bring in our technical personnel specifically to spend as much time as our convention-goer needs to answer their every question about our particular VHF/UHF equipment lineup. We are there to answer questions—there is no pressure in our booth to buy equipment." And this is a good opportunity for you to upgrade your operating skills without fear of having someone put the squeeze on you to break out the checkbook. The equipment and accessory manufacturers are there for information—and this helps support those dealers who are there at the show, selling this type of equipment.

In order to best take advantage of factory personnel at a ham radio convention, write down your questions ahead of time, and ask the factory representatives which person in their booth is the best one to see to answer your questions. Schedule an appointment with this expert, and maybe find a nice quiet place where you can both sit down and go over your questions. And since it's tough to stand booth duty all day, you might want to buy an extra soft drink and some munchies for this expert and have a nice sit-down session that you will both appreciate.

What to Look For

A very common question from a first-time ham equipment buyer is, "Why is your equipment any better than the competition's?" While this is indeed a logical question, only YOU will be able to come up with the right answer. There is absolutely no one brand line of equipment that will be necessarily best for you.

One of your upgrade skills will be to check out each piece of equipment yourself and see which one has those particular features that may best suit your communication needs. For instance, some 2 meter handhelds have expanded receiver capabilities to tune into aircraft receive-only frequencies. If you are a pilot, this is a feature you might want. However, if you're not interested in anything other than superb 2-meter-only reception and transmission, you may want to focus in on a handheld or mobile unit that is specifically tuned only to the 2 meter band without receive-frequency expanded band limits. And these are features that you might not discover on your first trip down to the local ham radio store, or your first browse through that great color catalog that was sent to you in the mail.

And you don't necessarily need to be a ham to take advantage of the upcoming hamfest. It gives you a great view of the new hobby that awaits you. And even though you might not have FCC call letters yet, you can always buy your equipment ahead of time, and use it for receive-only purposes to increase your technical skills as well as your code speed skills. Ham radios may indeed be sold to non-ham operators. Just be sure to tell the seller that you are serious about getting a ham radio ticket.

So when is the local ham radio "hamfest" coming to your area? Even a little one-day hamfest is bound to give you some important facts on how to upgrade your technical knowledge on the selection of equipment, setting it up, and using it. Get with the experts, and you'll upgrade your skills quickly. RF

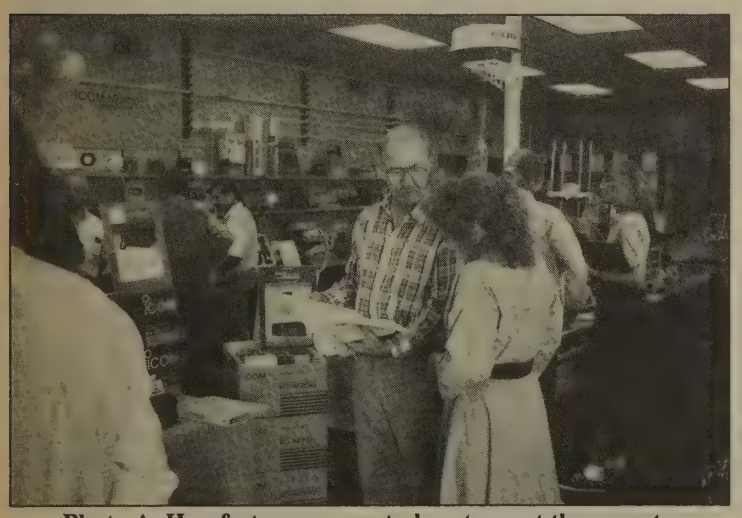


Photo A. Hamfests are a great place to meet the experts.

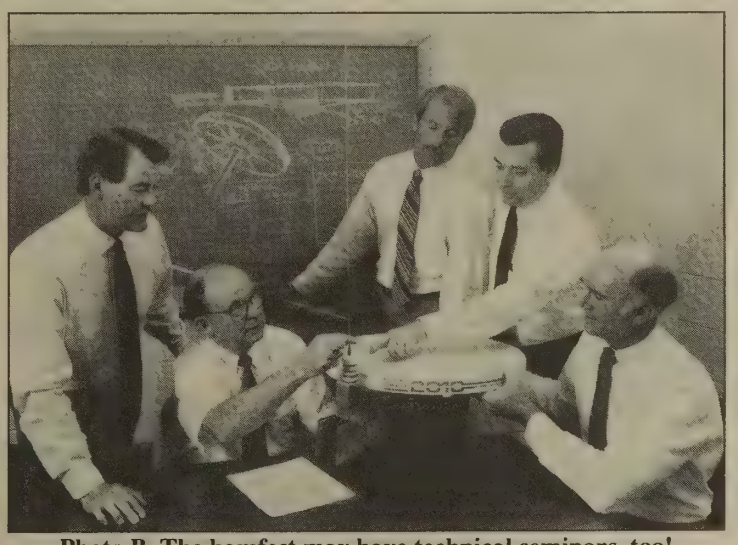


Photo B. The hamfest may have technical seminars, too!

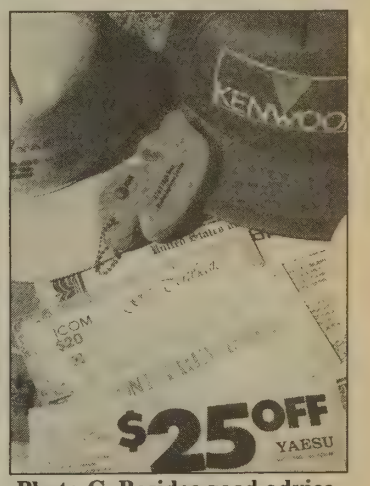


Photo C. Besides good advice, the hamfest exhibitors may provide you with additional free items.

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My Family of Hams

by Christopher Breish KA3YFK

In late October 1990 our family decided to take up amateur radio as a "family project." I was all for it, but my older brother Jay needed some extra encouragement. By listening to the local Quakertown, Pennsylvania, repeater we were able to find a hamfest. We looked all around with great anticipation. We picked up a copy of *Tune in the World with Ham Radio* and asked around for information on Novice classes. We were directed to Warren Erdman K3ZXQ. Warren took our names and "signed us up" in his soon-to-start Novice classes.

The classes did not last long for the family. My Dad passed his Novice theory and code on November 15, 1990, after an extended study session while waiting (over four hours) for his boss in the Orlando Airport. Upon returning home, Mr. Erdman came over to our house to administer the tests. It was great to have our family "elmer," Mr. Dee Hester N6BQR, there to sign the paper work for submission to the FCC.

"Black Friday," November 23, 1990, was not so black for our family. It seemed as if it were "Good Friday" for us. Mom, Jay and I all passed our Novice tests that day; Dad even passed his Technician theory test. Mr. Erdman accidentally played a 13 wpm tape and I thought I was a goner.

Dad had promised both Jay and me he would get us a radio *if* we passed our test. Well, Dad came through with two brand-new ICOM 03ATs for the holiday. Our new licenses showed up in the mail the last week of 1990. Mom was issued KA3YFL, Jay was issued KA3YFJ, Dad was issued N3IVB and I was issued KA3YFK. We were on our way now.

Although Dad wanted all of us to be at least Technician class, Mom was the only one to do so, in January of 1991. Mom was issued her N3IWL call in early February. I think Dad had it planned that way. He got Mom a 2 meter 440 radio which she couldn't use until she was a Technician.

Instead of watching TV in November 1991, I listened to the Gordon West WB6NOA theory tapes that Dad had gotten for Mom. Each evening I would go to sleep listening to "Gordo." Then, after reviewing the question pool with Dad, I took my test. I aced it! Wow! What a feeling! Dad said it would be easy to go on to General theory with the Technician so fresh in my mind. Again, I listened to "Gordo" as I went to sleep, reviewed the question pool, and again I aced the test!

Then I was on to the 13 WPM code test. Dad has a copy of "Super Morse" (by M. Lee Murrah WD5CID) and that helped me get back in the swing of things. I had not used the code for almost a year. It took about two weeks (10 minutes in the morning and 10 minutes in the evening) to get up speed to pass the test.

Again, late in 1991, Dad offered Jay and me an incentive to upgrade. We could add something to the shack *if* Jay upgraded to Technician and I upgraded to General by January 6, 1992. When Jay and I both passed, we both suggested adding packet to our station. Dad got us a multimode TNC so now we can be contacted on the WB3JOE BBS (145.090), not to mention the other modes.

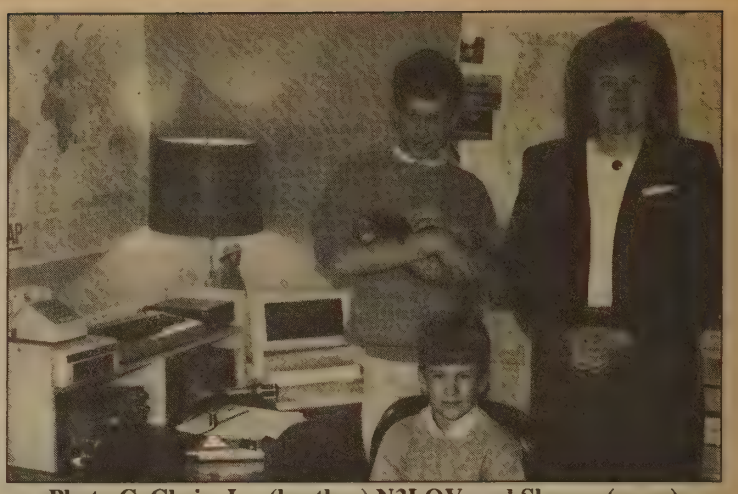

Photo C. Chris, Jay (brother) N3LQV, and Sharon (mom) N3IWL. (Jay is holding family pet, "Bandit.")

I was looking forward to getting on 40 meters and "The Fish Net," now I can. Some of my friends are Tom KA1UGH, Rick KD1BR, Brian WS3F, Joe Sr. WA1JKS, Jack N2JTO, Ken N1GPL, Alan KF8PM, Derrick WM1U, Marty KA1IRA, Dave N4FFG, and Fran KA3WTF.

I enjoyed working Christmas City Special Event Station W3OK on December 21, 1991. I made some 40 contacts. Some of the contacts were my Fish Net friends.

Dad kept ahead of us—he took his Advanced and Extra elements in November and December of 1991. He was issued his KE3AH call on December 12, 1991.

February 11, 1992 brought three new licenses to our house. Jay was issued his Technician call N3LQV, Dad was issued his WV3M call, and I got my good old KA3YFK (Young Fine Kid) only this time with *General* printed on it.

Mom may try to go on to General. I hope she does so when I go away to school I can talk to her.

I was eight years old (almost nine) when I passed my Novice tests. I was nine when I passed the Technician and General elements. I hope to upgrade to Amateur Extra over the summer.

I want to take this opportunity to thank all my friends who have helped and encouraged me along the way. Steve N3ANW took time to come and see me take my General code test; Bob WF3H saw to it that I could work W3OK. Thanks to all my Fish Net buddies (even though they are "a little older than me"), and of course, my "Family of Hams." RF

Photo A. Chris KA3YFK in family ham shack.

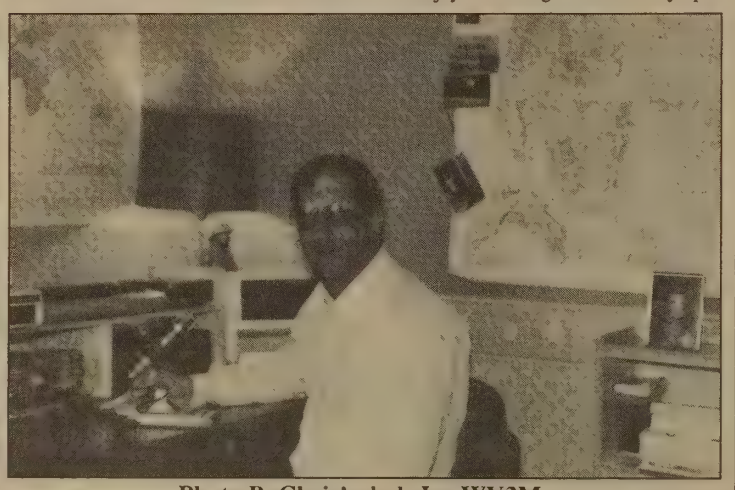

Photo B. Chris's dad, Joe WV3M.

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CIRCLE 136 ON READER SERVICE CARD

try something new

by Bill Brown WB8ELK

Putting It All Together

In the past two issues we looked at some of the more common electronic components you're likely to run across in circuit diagrams. This month we'll put together the components we've discussed into an actual working circuit.

The Timer Circuit

Using just one integrated circuit and a handful of additional parts, we can build a simple and very useful timer.

The heart of the timer circuit is a special IC called the 555. Housed inside of this small 8-pin plastic package is circuitry that allows you to control the state of one of the pins (pin #3) via a few external components. Pin 3 will be either at ground potential (0 volts) or it will be at a positive voltage nearly equal to the regulator supply voltage.

The rate at which pin 3 changes its output is determined by capacitor C3 (the 100 µF electrolytic) and the values of R3, R4, R5 and R6. You could replace diodes D1, D2 and resistors R3, R3, R5 and R6 with just one resistor if you desire. However doing this will cause the "on" time of pin 3 to be the same as the "off" time (for example: 1 minute ON and 1 minute OFF). The circuit as shown in Figure 1 allows you to independantly control the charge and discharge times of the capacitor depending on the values of potentiometers R5 and R6. Note: a potentiometer is a variable resistor.

IC1 is a three terminal device that is a voltage regulator. It allows you to take a higher voltage that may vary and drop it down to 5 volts (in the case of the 7805 IC) and maintain that level very precisely. Capacitors C1 and C2 help maintain the stability of the voltage regulator.

To turn the relay on or off, transistor Q1 is controlled by the output of the 555's pin 3. Whenever the output of pin 3 is high (a positive voltage), transistor Q1 will conduct and put a voltage potential across the relay (RL1A or RL1B) causing the relay to close. If the output of pin 3 is low (ground potential or zero voltage), then the transistor will not conduct and the relay will open up since there is now no voltage across it. The amount of time that the relay is "on" or "off" is controlled by the settings of R5 and R6 and the value of capacitor C3.

Using PC Boards

The PC board (short for printed circuit board) is a remarkable time saver when it comes to turning a schematic diagram into an actual working circuit. Before circuit boards, you had to hand wire the components together with a maze of wires. The chances of misreading one wire placement rapidly increased with the complexity of a circuit. Fortunately, the PC board solved a lot of problems.

A PC board consists of a Fiberglass sheet with a thin layer of copper foil laminated to its surface. Thin metal copper traces that comprise the wire connections between the components are produced by etching a pattern into the copper. This can be done through a variety of methods. One of the easiest ways is to use an etch-resist pen and physically draw your wire connections onto the copper surface of a blank PC board. Then drop it into a tray of Ferric Chloride solution until the copper that is not covered by your drawing has etched away. BE CAREFUL as Ferric Chloride is a CORROSIVE solution: DO NOT splash it on your clothes or get it on your skin. For the more adventursome, Radio Shack offers a kit that you can use to etch your own circuit boards.

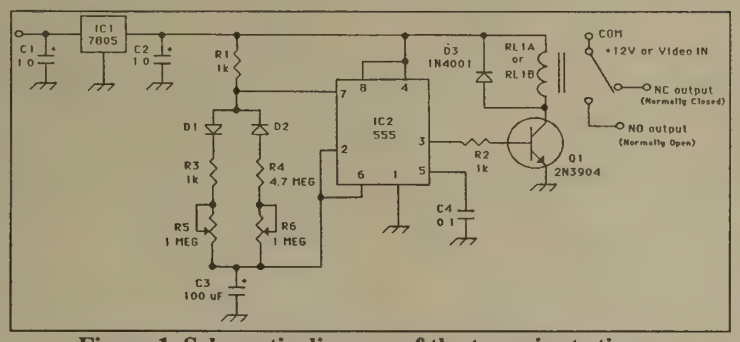

Figure 1. Schematic diagram of the ten-minute timer.

One of the more innovative systems involves using a transparency film called TEC-200 (available for $3.95 + $1.50 postage for 5 sheets from The Meadowlake Corp., Dept. R, P.O. Box 497, Northport NY 11768). You just photocopy the PC foil pattern layout from a magazine onto the film and iron it down according to their instructions so that the photocopier toner on the transparency melts and transfers to the surface of the copper foil. Just touch it up with an etch resist pen and etch it in Ferric Chloride solution. Now all you need do is to drill out the holes with a very fine drill bit (#58 or smaller).

Of course, if the idea of splashing corrosive chemicals around isn't your idea of fun, you can quite often purchase a PC board that is already etched and drilled for many of the projects and articles you might want to build (see the Parts List for availability of the Timer PC board).

Assembling the Timer Circuit

To build our timer board using the PC board, lets take a look at Figures 2 and 3. Even if you can't follow the schematic diagram of the circuit, you can usually assemble a working circuit if the Parts Placement diagram is complete (see Figure 3). Figure 2 shows the copper foil side of the board with the timer trace pattern in place. This is the side where all of the solder connections are made when the components are installed. Use the Parts Placement diagram to install each component from the top side of the PC board (the opposite side of the foil side). Wherever you see a component lead sticking through one of the holes on the copper side of the board, just solder it in place. Its a good idea to carefully install only a couple components at a time and double check your work as you go along to avoid sticking parts in the wrong location.

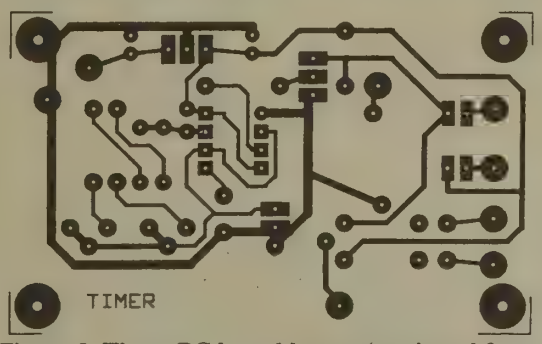

Figure 2. Timer PC board layout (as viewed from the metal foil side).

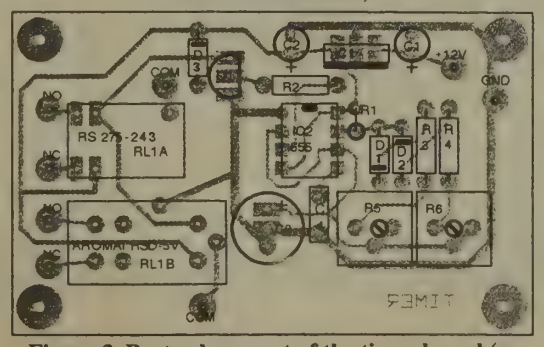

Figure 3. Parts placement of the timer board (as viewed from the component side of the PC board).

Parts List

R1,R2,R4	1k ohm, 1/4 watt resistor (RS#271-1321)
R3	4.7 megohm, 1/4 watt resistor (RS#271-312)
R5,R6	1 megohm potentiometer (Digi-Key# 3386P-105-ND)
C1,C2	1.0 µF/35 volt tantalum capacitor (RS#272-1434)
C3	100 µF/35 volt electrolytic capacitor (RS#272-1028)
C4	0.1 µF disc ceramic capacitor (RS#272-109)
IC1	7805 5-volt regulator (RS#276-1770)
IC2	555 timer IC (RS#276-1718 or RS#276-1723)
Q1	2N3904 NPN transistor (RS#276-2016)
D1,D2	1N914 diode (RS#276-1122)
D3	1N4001 diode (RS#276-1101)
RL1A	5-volt relay, Radio Shack# 275-243
RL2A	5-volt relay, Aromat RSD-5V (see Note 2)
Misc	8-pin IC socket, PC board (see Note 1)

NOTE 1:An etched and drilled PC board is available for $4 + $1.50 shipping/handling per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

NOTE 2:The Aromat RSD-5V relay is available for $2 + $1.50 shipping/handling from ARE Surplus, 15272 S.R. 12 East, Findlay OH 45840. Phone: (419) 422-1558.

NOTE 3:All parts are available through mail order from Digi-Key at (800) 344-4539.

Timer Operation

This timer in Figure 1 comes in very handy for all kinds of control applications. For example, you can use it to remind you when to ID your station by hooking up a beeper and battery to the relay output. Just hook up the negative lead of a 9-volt battery to one side of a Radio Shack beeper (RS #273-066). Then attach the other lead of the beeper to the "NO" point of the relay and the positive lead of the 9-volt battery to the "COM" point on the

Continued on page 10

If you'd like to see how the PC board pattern relates to the schematic diagram, refer to the Figure 3 and observe how the PC board foil traces between components correspond to the wire connections shown in the schematic.

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CIRCLE 68 ON READER SERVICE CARD

the tech side

by Michael Jay Geier KB1UM

Fixing Power Supplies

Probably the most common failure you will ever see in any of your gear involves the power supply. Why? Because it is common to everything else. Also, it takes a great deal of stress.

All Stressed Out

Just what is "stress" in an electronic circuit? There are two basic kinds: thermal and electrical.

Thermal stress is just what it sounds like—a part overheats. In most cases, overheating is caused by too much current being pulled through the part. Perhaps I should say "power," because the voltage also must be taken into account. Heat is generated by power, which is expressed in watts. Since watts are equal to voltage times current, obviously both matter. But in practical solid-state circuits, the voltage usually is pretty low, making the current, which varies depending upon the load, the dominant factor.

There are two common reasons for a part's having too much current going through it. Either the part itself is shorted or some *other* part is drawing the excessive current. Remember, in a series circuit, all the current flows through all the parts, with the voltage being divided between them.

So, if a certain amount of current flows through a part, it will heat up by a predictable amount, right? Sorry, it's not that simple. What matters is the current, multiplied by the voltage *drop* across the part. So, a part with very low resistance (a short piece of wire, for instance) may pass all the current without even getting warm. Another part with higher resistance may get quite warm, because its voltage drop is much higher. Remember, the power which is resisted by a resistor is converted to heat; those watts have to go somewhere. Of course, as the resistance goes up, the total circuit current goes down, so there is a point after which things start to cool off.

Zap

Electrical stress refers to a part's breaking down because the voltage across it is too high. A good example is what happens to electricity in air. At low voltages, air is a good insulator. Heck, nothing happens between the terminals of a 9-volt battery, right? If the voltage is high enough, though, the air will break down and current will flow from one point to another. Voilà, lightning! In air, you can plainly see the arc when breakdown occurs. Of course, it doesn't take thunderstorm-class voltages for air to break down. Even a few hundred volts can cause a spark between two points if they are close enough together. In some solid materials, it takes much less. Semiconductor devices like transistors and ICs are made in layers, with some of the layers only microns thick. At that scale, some parts can break down with only a few volts across them!

In most cases, the breakdown voltage of a part is specified. A notable exception to that "rule" regards resistors; they are rated for total power dissipation (the thermal stress issue), but they can be expected to work fine at any practical voltage. In high voltage situations, though, such as are encountered in tube-type RF output stages and especially linear amplifiers, resistors can break down and arc. For most of the circuits you'll encounter, though, the breakdown voltage rating of resistors is not a concern.

Capacitors are another story. The basic construction of a capacitor, which is two plates separated by an insulator, suggests that an arc is possible, and it is. All capacitors are rated for breakdown voltage. Ceramic disk caps can range from 50 volts to thousands of volts! Electrolytics, used as power supply filters and audio couplers, tend to be rated much lower. Typical ratings are from 10 to 50 volts. And electrolytics, particularly the tantalum type, aren't tolerant of overvoltages, either. It takes very little abuse to destroy these caps. That's because the insulator in electrolytic caps is a very thin layer of metal oxide. The extreme thinness of the layer is what gives the parts their high capacitance in such small sizes, but the oxide is easily punctured by excessive voltage.

The same is true of many semiconductors. In particular, CMOS (Complementary Metal Oxide Semiconductor) parts are made somewhat like electrolytics: The layers are separated by a thin layer of metal oxide. In the early days of CMOS technology, static electricity was a major cause of chip failure. Today, all CMOS parts are protected by internal input diodes which short any zaps before they exceed the oxides' ratings. Even so, the parts should be treated carefully and never handled in static-prone areas.

Some transistors, notably MOSFETs, are made from MOS technology. But even regular bipolar transistors and non-MOSFETs are internally layered and can be fairly easily destroyed. For that matter, TTL integrated circuits (such as those of the 7400 series) are redesigned to operate at 5 volts, and even 6 volts will blow them if applied for more than a few moments!

Back to Power Supplies

Now that you know the basic failure modes of electronic components, you're ready to start looking at broken power supplies.

When your rig quits, take a good look at it. Is it doing anything at all? If, for instance, the lights are lighting up, then the power supply probably is working. If, however, there is nothing going on at all, and you know that power is applied, the power supply is the first place to look. Here's a valuable secret: Most power supply failures are caused by something in the load (the radio) drawing too much current. In other words, the real problem is somewhere else! Of course, you've got to fix the supply anyway, but don't expect that repair to be the end of your journey.

The first thing to check is whether there are any blown fuses. Most power supplies have one or more of them, and they usually do their job of protecting the supply pretty well. With most fuses, you can plainly see if they are blown, but I have seen a few which looked fine and were open. Once, I even saw one with several ohms of resistance! I still don't know how it was doing that, but the result was that the supply's output voltage was very low, but the darned thing still worked. It took quite awhile to figure that one out, because fuses aren't supposed to be able to do that. Needless to say, it was a fluke, and you shouldn't expect to see something like that.

Got One!

OK, you've found a bad fuse. If you can see the melted conductor, take a close look at it. Is it merely fractured? If so, it may be that it simply weakened and failed, especially if the supply is a few years old. If that's the case, a new fuse may be all you need! But don't count on it. Most likely, you'll see signs of real melting, with metal on the sides of the fuse or spattered bits of it inside. These are signs that something pulled way too much current through the fuse, and you can expect to find something shorted, either in the supply itself or, more likely, in the radio. (A hint: If the fuse is blown, something is shorted. If it is not blown, something is open.)

Sleuthing

Once you've determined that there's a short somewhere, start looking for it by taking resistance measurements. First, be sure to remove all power from the supply (unplug it, please!) and discharge the filter capacitors to ground with a low-value resistor (perhaps an ohm or so) across their contacts for a few moments. To be sure they're discharged, measure the voltage across them; it should be very close to zero. If there's still a volt or two there, use a direct short with a cliplead to complete the discharge.

Now, switch to the ohms setting on your meter and look around. It is important that you know what should be there, in order to avoid going around in circles or ordering parts which don't need replacing. In order to know that, you need to have some understanding of the basic workings of the supply you're testing.

Two Ways To Go

There are two basic kinds of power supplies: linear and switching. In linear supplies, the incoming AC power is fed through a step-down transformer and then rectified (changed from AC to DC), filtered and regulated. In switching power supplies, the incoming AC power is rectified and filtered, and then chopped at a high frequency. Then, it is fed through a small transformer and finally rectified again and filtered and regulated. Be warned: Switching supplies are very dangerous to play with whenever they are plugged in, because much of the circuitry is not isolated from the AC line.

There's a variation on these schemes: the linear supply with a switching regulator. In this configuration, the incoming AC is fed through the step-down transformer, rectified and filtered. Then, it is chopped at high frequency and regulated by a pulse width modulator (which I'll explain later), in the same way as is done in switching supplies. For repair purposes, though, you can consider such a hybrid supply as a linear supply.

Most radio gear uses the linear supply approach because switching supplies tend to generate RF noise in the receiver. As switching supply designs are improving, though, they are showing up more and more. How can you tell which you have? Look at the power transformer. If it is large, the supply is almost certainly of the linear kind, although it could be a hybrid. If one side of the transformer is connected directly to the AC line (through the on/off switch), that's a dead giveaway that you're dealing with a linear or hybrid supply. If, however, the transformer is very small, and you see warning stickers around the supply, it may very well be a switcher. Typically, switchers have various small inductors (coils and transformers). Also, the AC line (after the on/off switch) will be connected directly to rectifiers and other circuits. Once you've correctly identified linear and switching supplies, you'll be able to recognize them in the future.

Holding Steady

Linear regulators use a transistor as a variable resistor. These regulator circuits examine the supply's output voltage and adjust the amount of resistance in the "series pass" transistor so that just enough power flows to keep the output voltage where it is intended to be.

This approach works fine, but it suffers one big drawback: As with any resistor, the transistor must waste the extra power (the difference between what is going in and coming out of it) as heat. That's why the transistor usually has a big heat sink on it. Needless to say, it's a wasteful way to regulate. Its prime advantages are that it is simple and generates no RF noise.

Switching regulators use the pulse width modulation (PWM) scheme, just like switching power supplies. In this method, the power is chopped into pulses, with the width of those pulses being adjusted so that, when the power is smoothed back into DC, the voltage is set to its proper value. The wider the pulses, the more power is transferred in each one, so the higher the final output voltage rises. Conversely, the narrower the pulses, the less power is transferred and the lower the output voltage.

The big advantage of the PWM scheme is that the pass transistor is always either on or off, and nowhere in between. It is being used as a switch, rather than as a resistor. So, very little waste and very little heat are produced. It's extremely efficient.

Unfortunately, it is somewhat harder to do, so it costs a bit more. Also, the rapid switching of the pulses tends to cause RF noise which is hard to remove.

Well, there's lots more to cover before you start digging in and fixing those supplies. We'll try to finish up next month. 'Till then, 73 from KB1UM. RF

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by Philip Chien KC4YER

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Photo B. STS-45 onboard view. Astronaut Charles F. Bolden, mission commander, talks to amateur radio operators on Earth from the flight deck of the orbiting Space Shuttle *Atlantis*. The space-to-Earth calls involving the STS-45 crew members and licensed hams on the ground were part of the continuing SAREX project. (Photo courtesy of NASA.)

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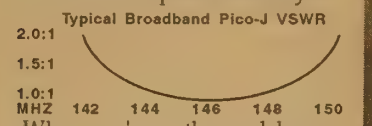

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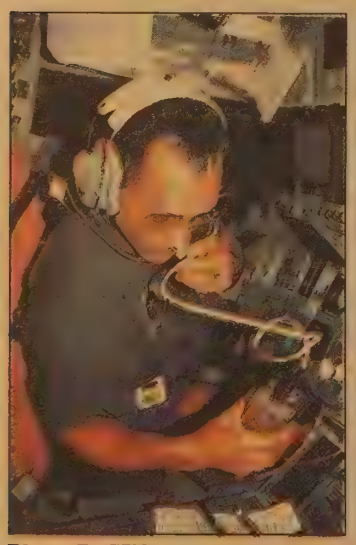

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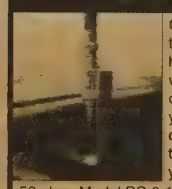

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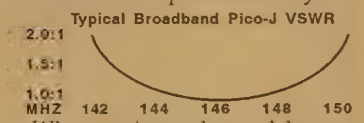

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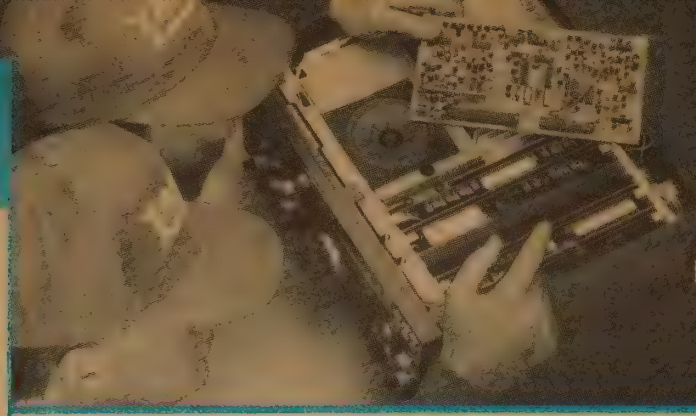

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mission. Afterwards Brian commented, "It made my whole day, when we were up there, having the opportunity to speak to my children was just terrific. I looked forward to it ahead of time, hoping that I'd get a chance to talk to them, and it all worked out. It was a great chance."

With the launch of *Atlantis* hams from the United States, Belgium, Russia, and Germany were all in space at the same time. Unfortunately, the first *Atlantis/Mir* conjunction occurred after Sergei left *Mir*. Dave and Brian had talked to Sergei from W5RRR's ham shack while they were in training, and were looking forward to talking to him in orbit. Sergei did pass on his regards to the *Atlantis* crew via ground controllers, though. Contacts with *Mir* were attempted several times during the mission, but only got as far as Dave Leestma reporting that he had heard *Mir* on one occasion.

While the SAREX project is not officially part of the International Space Year, the STS-45 mission had a heavy emphasis on international educational contacts. Besides the continental United States, the crew had pre-planned contacts with Saipan, Norway, Canada, Denmark, Germany, Brazil, and—of course—Belgium. It was especially useful that Dirk speaks four languages (Dutch-Flemish, French, English, and a little German) and Kathy speaks four (Norwegian, French, German, and English).

During the eight-day mission Brian, Dave, and Kathy all got to work all seven continents—including Antarctica. Dave described his contact with Q1IOQ at Palmer Station (65 degrees south) enthusiastically. "He had taken every radio in the place and strung them all together, and gone outside and strung some wire as an antenna. And he had been waiting for five days for the right passes, and was thrilled with the contact."

At one point Dave Leestma indicated that he had quite a pile-up, saying, "I had no idea there were so many hams in the Hawaiian Islands!" One of Dave's successful Hawaiian contacts was a young lady making her very first QSO. Unfortunately, the cassette recorder which Dave was using to record conversations and callsigns ran out of tape. If you are that lucky ham, or know who she is, then contact the Johnson Space Center Amateur Radio Club with her name and callsign.

Over 900 voice contacts were made during the mission and Dave Leestma made at least 500 of them.

To ensure the success of the educational contacts, the JSC Amateur Radio Club kept their ham shack manned around the clock. For each contact, many in time zones around the world, JSC hams monitored transmissions to and from the shuttle. At one point the team performed five widely separated school contacts within five hours.

SAREX is one of W5RRR's main projects, with team members dedicating much of their free time preparing for future missions. Members have dug into their own pockets on many occasions to purchase connectors and components necessary for flight and ground components. A SAREX fund has been set up to help support future SAREX flights. Donations can be sent to W5RRR, Johnson Space Center Houston, Texas 77058. In addition, SAREX patches are available for $5 plus $.50 for postage.

The rest of the ATLAS-1 mission went well too, with all of the instruments returning valuable data. All together ATLAS-1 sent back 800 billion bits of data—the equivalent of a two-mile-high stack of *Scientific Americans* filled with information.

Postscript

After the mission, several of the astronauts told us about their SAREX activities.

Charlie Bolden: I was somewhat lukewarm on SAREX when we started. I equated it with some other payloads that I've flown, that are a lot of fun for the crew, but tend to be very time consuming. I think we had two great advantages from SAREX—one was it put us in contact with the American public, and the public around the world, especially school kids. The two opportunities (Orangeburg, South Carolina, and Huntsville, Alabama) I had to get the headset on and listen to school kids—you could just tell that they were standing in line, chomping at the bit to get their question asked. And they didn't have a lot of time. They were very well prepared, they asked very, very clear concise questions that showed somebody had taught them something, or they had read in preparation for this. I never got a trivial question, in fact I got some that just watered my eyes, and the only problem I had was looking around for somebody that I could say "help me answer this question" to. That's the best advantage I saw in it. The second thing is somewhat more personal. We got an opportunity to communicate with our families while we were gone, if only briefly, for say two or three minutes. And that really helps to pick up the morale on both sides of the line there. It's not fun being a spouse of someone who is orbiting the Earth having a good time, while you're worried about them. And while we're having a good time, we're concerned about our families also. So it gave both sides of the equation an opportunity to see what was going on and feel a lot better about it.

Dave Leestma: The school contacts were really neat to talk to the kids. Another neat thing that I found with the SAREX was the opportunity that Brian and I and Kathy and the rest of the crew members had, just talking with the hams around the world. And how excited they were to be able to talk to the shuttle, and to be able to communicate to somebody on board, the enthusiasm they have for the American space program. We talked to people from South America, Africa, Asia, Europe, Antartica, New Zealand, Australia, and Southeast Asia. And everybody that talked to us was very excited and delighted. I remember one instance when I was coming over New Zealand I was talking to somebody and I noticed that, looking down, they were in darkness but we were in bright light, and I told them, why don't you go and look outside. We're coming over right now. About 30 seconds later he came back on the radio and said, "I saw you! I saw you!" and they watched us fly over while we were talking to them. I thought that was kind of an exciting thing to do.

Kathy Sullivan: I was astounded to find the lengths that people were going to, around the world, to follow our flight and to find out when we would be overhead. The evening before we stowed the SAREX antenna we had three different orbits that came across Australia in what was the middle of the night on the ground. I put the antenna in the window for each one of those three passes, and was just flooded with calls on every pass. There were at least two different callers that had their young children, young daughter and young son up with them and said that they had been up every night that week through the middle of the night hoping that they'd get a contact with us, and using that as a vehicle to spark their kids interest in space and the space program. It's really pretty exciting to see the amount of enthusiasm that it generated around the world.

Brian Duffy: Another thing that was nice about it was seeing just exactly how polite and how organized the people were on the radio. We almost envisioned having a mob scene when we were up there because we can speak down and everyone can hear us, but they can't hear each other, so they're all trying to answer. When we were able to pick up a call out of the crowd and be able to speak with them, the other people were very polite and listened and waited until we were finished, and that was universal.

Dirk Frimout: I was very glad I was able to speak to people in Belgium. A school had questions in Dutch and French that I could answer. It was very exciting for me to get these calls from Belgium. I had some contacts with other people in Belgium, but that was a little more difficult. They were a little bit less disciplined than what Brian described. When I came over Belgium there were a number of calls and it was hard to pick out one and just speak to one at a time.

It's significant to note that STS-45 marks an important change for SAREX's status within the shuttle program. For previous SAREX missions an astronaut already assigned to a mission, who happened to be a ham, might ask that SAREX be included as a secondary payload. Now the SAREX team is also looking at shuttle flights with mission objectives which will provide the best SAREX opportunities, and asking astronauts on those missions if they would be interested in flying with SAREX. With four configurations, ranging from 11.4 kgs. (25 lbs.) to 29.5 kgs. (65 lbs.), SAREX can be squeezed aboard missions where there isn't much room, or flown with several different modes to permit more experimenting when there is room. Some SAREX opportunities will be missed when there isn't enough room in the crew timetable or enough time for a crew member to be trained to use the SAREX hardware, but more flights will be available to choose from.

Thanks to the efforts of many Johnson Space Center hams, most notably astronaut Ken Cameron KB5AWP, there are now 10 active astronauts with ham licenses: Steve Nagel N5RAW, Ken Cameron KB5AWP, Jay Apt N5QWL, Linda Godwin N5RAX, Jerry Ross N5SCW, Brian Duffy N5WQW, Dave Leestma N5WQC, and Kathy Sullivan N5YYV. Dick Richards KB5SIW and Ellen Baker KB5SIX. In addition, Dr. Ron Parise WA4SIR, a payload specialist on the ASTRO-1 mission, hopefully will fly with SAREX again on the ASTRO-2 mission.

On the international scene SAREX will be flying on the Spacelab Japan and Spacelab Germany missions. The German space agency, DARA, is interested in flying SAREX on the upcoming Spacelab D2 (Deutch) mission in March 1993. The commander for that mission will be ham astronaut Steve Nagel who was the pilot on the first all-German Spacelab mission (D1 in October 1985). The payload commander is ham astronaut Jerry Ross. Other crew members assigned include pilot Tom Hendrix, mission specialists Charlie Precourt and Bernie Harris, and German payload specialists Hans Schlegel and Ulrich Walter.

During the first German Spacelab mission, the German payload specialists operated their own ham hardware, however it was not part of the SAREX program, and was primarily limited to contacts over Western Europe. For the D2 mission U.S. hams will also participate and SAREX will include worldwide participation. In addition, the D2 mission will include the deployment of a small satellite, *Bremsat*.

SAREX is an extremely high profile educational project, and has wide support within NASA. As more astronauts get their ham licenses and missions are flown with good SAREX educational opportunities, SAREX will become a more common part of the shuttle program. Hopefully it will eventually become standard crew equipment, and flown on almost all missions.

SAREX Continues

W5RRR/S will be the shuttle's call for all future SAREX missions. Besides making things more standard, the JSC Amateur Radio Club won't have to burn in a new callsign ROM for each slow-scan TV mission. Two SAREX missions are scheduled to fly this summer: the STS-50 US Microgravity Laboratory and the STS-47 Spacelab Japan mission.

STS-50

The STS-50 *Columbia* mission (currently scheduled for late June) will feature the first Extended Duration Orbiter flight, for a shuttle record 13 days in space. The mission will carry the United States Microgravity Laboratory (USML) on its first flight. Commander Dick Richards and mission specialist Ellen Baker expressed an interest in SAREX and decided to become hams. They have passed their tests and recently obtained their calls. Dick was assigned KB5SIW and Ellen has the call KB5SIX. Dick was originally assigned to the 61-E ASTRO-1 mission in March 1986—the mission which was scheduled to follow the 51-L *Challenger* mission. After the *Challenger* accident he was reassigned to the STS-28 *Columbia* flight, a secret Department of Defense mission which deployed two secret satellites. His second mission was as the commander of STS-41, which deployed the international Ulysses probe. Dr. Ellen Baker flew aboard the October 1989 STS-34 *Atlantis* flight which deployed the Galileo planetary probe to Jupiter. Dick and Ellen's other crew members on the USML mission are pilot Ken Bowersox, mission specialists Bonnie Dunbar and Carl Meade, and payload specialists Larry DeLucas and Eugene Trinh.

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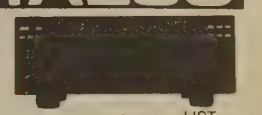

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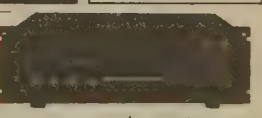

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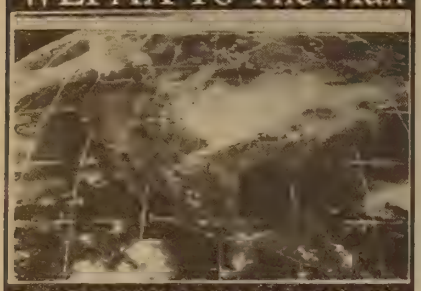

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the SAREX-D configuration which flew with the STS-37 crew, including voice, packet, two-way slow-scan, and fast-scan receive modes. To save space the crew will not be using the combination VCR/monitor used on the STS-37 mission. The shuttle's monitors will be used to view video transmissions from the ground and video will be recorded on the 8mm camcorder. More importantly, the current SAREX antenna would not work well on STS-50 due to the shuttle's attitude. The USML mission requires a gravity gradient attitude, with the shuttle's tail pointed towards the Earth. The dual-band antenna (2 meter voice/packet/SSTV, 70cm ATV) has been repackaged into a rectangular antenna which fits into an overhead window, similar to the antenna used on the Spacelab 1 and Spacelab 2 missions.

Since Dick Richards is the commander he can set his schedule as required, and has more free time than the other astronauts. Ellen's normal schedule is the opposite of Dick's, permitting fairly constant SAREX operations. STS-50 is a low-inclination (28.5 degree) mission, and the educational contacts will use a phone bridge, similar to the bridges used for the STS-35 and STS-37 missions. To keep U.S. passes clear for random CQs, the ground station for the bridge will be outside of the CONUS region.

STS-47

The STS-47 *Endeavour* mission will feature Jay Apt N5QWL, who flew aboard the STS-37 mission, making Jay the first ham to operate SAREX aboard more than one mission. The commander of the mission will be Hoot Gibson and the pilot will be Curt Brown. Jay's fellow mission specialists will be Mark Lee and Jan Davis. The two payload specialists are NASA mission specialist Mae Jemison flying as a "science mission specialist" and Mamoru Mohri flying as the first Japanese scientist in space. This mission will also feature the first married couple flying together on the same mission, Mark and Jan; however they will be on opposite shifts. Jan and Mae will work with Jay on the blue shift, unfortunately the shift which will be asleep during most U.S. passes. Curt, Mark, and Mamoru will work on the red shift. Commander Hoot Gibson will adjust his schedule as required.

SL-J will be a high-inclination mission, with many passes over Japan and the continental United States. The mission will include the SAREX-C configuration with packet and voice operations, similar to Ron Parise WA4SIR's STS-35 ASTRO-1 mission. Many educational contacts are planned, including several with Japanese students. Proposals for preplanned educational contacts should be sent to the ARRL before June 1st.

Photo C. STS-50 insignia. Designed by the flight crew, the insignia captures a space shuttle traveling above Earth while trailing the USML banner. (Photo courtesy of NASA.)

Two enthusiastic ham astronauts have been recently assigned to future missions. Ken Cameron KB5AWP has been assigned as the commander of the STS-56 ATLAS-2 mission, a re-flight of many of the ATLAS-1 experiments. His pilot will be Steve Oswald, and the mission specialists will be Mike Foale (who just flew on the ATLAS-1 mission), Ken Cockrell, and Ellen Ochoa.

Brian Duffy has been assigned as the pilot for the upcoming STS-57 mission. His commander will be Ron Grabe, and the mission specialists will be Dave Low, Janice Voss, Jeff Wisoff, and Nancy Sherlock. That mission will feature the Spacehab module, an extension to the shuttle's crew cabin, and the retrieval of the European Eureca carrier.

Non-SAREX Missions With Indirect Ham Involvements

During the November 1991 STS-44 mission the Soviet cosmonauts aboard *Mir* listened to *Atlantis*'s launch on their ham rig via a ham repeater and had an excellent view of the launch from their orbital perch. Sergei told a Goddard ham on vacation about his exciting view, and the cosmonauts' greetings were passed on to *Atlantis*'s crew via mission control.

Unfortunately SAREX couldn't be added to the STS-42 International Microgravity Laboratory mission in time due to that crew's busy schedule. By coincidence its launch placed it in an orbit which nearly coincided with *Mir*'s orbit, and if SAREX had been aboard, the U.S. and Soviet cosmonauts could have talked several times during the mission. RF

Photo D. Commander Richard N. Richards KB5SIW, STS-50. (Photo courtesy of NASA.)

Photo E. Mission Specialist Ellen Baker KB5SIX, STS-50. (Photo courtesy of NASA.)

radio magic

by Michael Bryce WB8VGE

More Test Equipment

There are two more pieces of test equipment you may want for your workbench: a frequency counter and an oscilloscope. While neither can be thought of as inexpensive, the price for general purpose equipment has really come down. You can pick up a good frequency counter for under $100. A scope can be obtained for less than $250. Let's take a closer look at each piece of gear.

Frequency Counters

As the name implies, a frequency counter counts frequencies. Most of the counters on today's market will count to the gigahertz range. Even the simplest frequency counters will do at least 512 MHz. Don't get a counter that won't cover at least the 2 meter band frequencies of 144-148. Some older counters on the flea market tables will only do up to 30 MHz.

The simplest use of a frequency counter is to set the frequency of a VFO, or to net the frequency of a crystal. You can also use one to check the output of a 2 meter rig, or to find the exact CW frequency of your HF transmitter.

But, I've found a use for the frequency counter that's a bit different. I use the counter as an RF sniffer. By using a two- or three-turn closed loop connected to the counter, you can sniff out RF and find the exact frequency of the RF at the same time. If you have a transmitter that just won't seem to tune up, a counter will lock on to the strongest RF field. If I have a transmitter tuned to the 40 meter band (7.0 to 7.30 MHz) and the counter finds RF at 14 MHz, I know that somewhere I'm doubling the frequency coming out of the tuned stages of the transmitter. The tuned circuits of the output filters won't pass the energy to the antenna. I can then use the counter to pinpoint the trouble area in the earlier stages of the transmitter.

If the frequency counter can't "lock" onto a frequency, there is a good possibility that there is more than one frequency flying about in the area you're checking. The counter will read random numbers as it tries to find the strongest RF source.

The same goes for checking out a low power stage of a home-brew QRP transmitter. If you suspect a local oscillator is not working in a receiver, a counter will really come in handy. With a frequency counter, you'll never have to guess if the output of the oscillator is on frequency, or even if the oscillator is running! If you've ever tried to build a direct conversion receiver and tried to find your VFO on a shortwave receiver, you'll be glad to never be without a frequency counter again.

There are many different types of counters on the market. There are handheld units and bench-top counters. I prefer the bench-top unit myself, but it is a hassle to carry it outside to check the frequency of a 2 meter rig in the family Buick!

Be sure you pick up the proper probe set with your counter. A clip lead just won't cut the mustard. A good quality probe is a necessity. You've got to keep the input of the counter shielded from any other inputs except what is going in from the probe's tip. If you buy a counter new, be sure you get the probes with the unit. In many cases, they're add-ons to the basic price of the counter. A good probe set, usually two probes, will run you about $50.

Oscilloscopes

The second piece of equipment for the shack is the oscilloscope. Some have said this is the most important piece of test gear any service technician should own. With an oscilloscope, you can see what the wave form looks like, read the amplitude of the wave form, and get a very good idea of the frequency of the wave form. In digital work, an oscilloscope is a gotta-have to view the clock pulses going to and from different digital chips. There's even more the oscilloscope can do when in the hands of a knowledgeable service tech. There just is not enough room to go into every detail of what you can do with the scope in these pages. There are several good books in print on using the scope for electronic testing and design. I urge you to read these books.

Oscilloscopes come in many different forms. Some are simple analog units, while there are also digital storage scopes with a built-in digital voltmeter and frequency counter.

You'll find oscilloscopes come in single or dual channels. This simply means there are two different inputs. You can watch the input on one channel while at the same time see what is going on at the output with the second channel. If you've ever read a product review in *QST* and seen the CW wave forms, you can see how they are done. One channel of the scope is connected to the key; the other to an RF pickoff of the actual RF being produced from the transmitter. For comparing the input of a signal to an amplifier and then seeing any change in phase angle, amplitude, distortion, or other anomaly, you can't beat the dual-channel scope. Unless lack of funds prevents you from buying a dual channel scope, get one.

Some companies, such as Tektronix, offer oscilloscopes with four or six channel inputs. These are very expensive and are used mainly in digital work.

I have a rather old and out-of-date oscilloscope on my workbench. I don't use it to measure frequency. I found the frequency counter much faster for me to use than the scope. I do use the scope to check an oscillator on a receiver and to get an idea of the oscillator's amplitude.

Another use for the scope is to check the Vcc (supply line) of a radio. I've seen single IC voltage regulators oscillate and put all kinds of junk on the Vcc line. This "junk" may cause all kinds of problems down the line. A scope connected to the Vcc line will show you any AC components riding on top of the DC voltage.

As with the frequency counter, a good set of test probes is an absolute must-have. You can't get by with a clip lead for a test probe. Most oscilloscopes will measure down to the millivolts and can easily pick up the stray electrical fields present in today's houses. You don't need these signals floating around with the signal you're trying to measure. Use good probes!

With four basic pieces of test gear you can manage to fix just about anything. There will be some cases where you'll need something special like an accurate wattmeter or a signal generator able to generate a signal up to the 500 MHz band. If you're really, really smart, you can get away without that signal generator, too. Next month, I'll tell you how and you'll be surprised at the method. RF

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RF vintage review

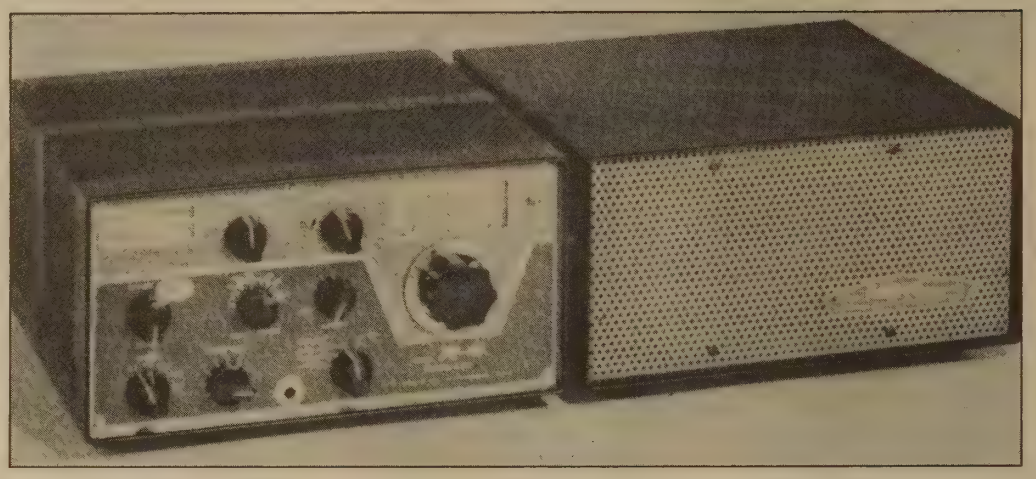
The Drake R-4 Receiver

by William Johnson WA2TDR

Recently I became the owner of a Drake Model R-4 receiver. After using it for several months I was impressed enough by its performance to write this review.

The model R-4 receiver is capable of receiving in the SSB, CW, AM and RTTY modes of operation. Its frequency coverage is 3.5 to 4.0 MHz, 7.0 to 7.5 MHz, 14.0 to 14.5 MHz, 21.0 to 21.5 MHz, and 28.5 to 29.0 MHz, with the crystals supplied. Ten accessory crystal sockets are provided for the coverage of any additional 500 kHz ranges between 1.5 and 30 MHz with the exception of the 5.0 to 6.0 MHz segment. This is one feature that I particularly like as the receiver can never become obsolete if any of the ham band frequencies are shifted. In addition, it covers the 160 meter band by using one of the 10 accessory crystal positions, or for the VHF enthusiast, the accessory crystal selector can be used to provide 5 MHz of continuous coverage for use with VHF converters. Too many equipment manufacturers are omitting the 160 meter band, where the Drake Company recognized that the band still belongs to the radio amateurs.

The first IF frequency of the R-4 is 5645 kHz. The receiver uses a crystal lattice filter at this frequency, giving excellent cross modulation and overload characteristics by providing selectivity before the gain producing stages. A tunable passband filter with selectivity switching is used to achieve additional selectivity at the 50 kHz intermediate frequency. Four degrees of selectivity are available, with no need to purchase additional filters. The passband at the 6 dB point on the switchable filters are 0.4 kHz for CW, 1.2 kHz for RTTY, 2.4 kHz for SSB, and 4.8 kHz for AM.



Excellent frequency stability is assured by the use of a permeability-tuned oscillator. The specification calls for less than 100 cycles drift after initial warm up. I have found that the stability is in accordance with their specification. The oscillator covers 4955 kHz of 5455 kHz and is premixed with a switchable crystal-controlled oscillator. The output of the premixer is 5645 kHz above the frequency of the desired incoming signal. A bandpass coupling transformer between the premixer and the first high frequency mixer attenuates the undesired mixer products.

When the mode switch is in the "SSB/CW" position the output of the 50 kHz IF amplifier is connected to the input of the product detector. When the mode switch is in the "AM" position the 50 kHz local oscillator is disabled and the IF signal is detected with a diode, providing AM detection without having to resort to zero beating the carrier as required by SSB receivers lacking the additional AM detection system.

The main dial is calibrated in 5 kilohertz divisions and has two scales. The 0 to 0.500 scale is used for bands 7.000—7.500, 14.000—14.500, 21.000—21.500, etc., and the 0.500 to 1.000 scale is used for bands 1.500—2.000, 3.500—4.000, 28.500—29.000, etc.

The vernier dial skirt is calibrated in one kilohertz divisions. The scale on the vernier dial is marked 0 to 25. The dial skirt is adjustable by pushing it in slightly and rotating it in the desired direction while holding the main tuning knob stationary. After adjusting the dial skirt, the 1 kHz divisions track across the main dial so that 5 kHz on the vernier dial skirt coincides with the 5 kHz divisions on the main dial. When the vernier dial skirt is calibrated using the built-in 100 kHz crystal calibrator the calibration accuracy is better than 1 kHz when the main dial is calibrated at the nearest 100 kHz point. The tuning dial turns easily without any backlash. The ease of tuning will be appreciated by the VHF operator who tunes across the complete dial when tuning crystal controlled converters.

The specifications list both the image rejection and the IF rejection in the ham bands as more than 60 dB. The internal spurious responses in the ham ranges is less than the equivalent of 1 μV signal on the antenna. I have not found any spurious responses, and have not expreienced any image frequency stations in this area appearing in the ham bands.

The specification claims less than 0.5 microvolts for 10 dB signal plus noise to noise ratio on all ham bands. I have not measured the sensitivity, but after comparing it with other receivers on the market claiming similar sensitivity it competes with the best money can buy.

Other features contained in the R-4 are: the noise blanker which can be used on CW, SSB, as well as AM and the permeability tuned "T" notch filter in the 50 kHz IF strip. This filter is capable of producing a deep notch which can be tuned across the IF eliminating interfering carriers in all modes of operation. The automatic volume control has three positions: off, slow, and fast. The receiver has provisions for muting the RF stage off during transmit. The premixed VFO output is brought to a connector so that the receiver can transceive with the T4X transmitter.

Using the receiver in my two favorite modes of operation, SSB and CW, the R-4 satisfied all my expectations. The features and construction are of the same caliber as the TR3 transceiver and the 2B receiver that earned Drake their present reputation as a manufacturer of amateur products.

The overall dimensions are 5-1/2" high, 10-3/4" wide, and 12-1/4" deep.

Incidentally, the later model R-4A is identical except for minor production changes, including a solid-state VFO. RF

Reprinted from 73 Magazine, *January 1966.*

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what next?

by Carole Perry WB2MGP

QCWA—Vintage Operators

If you are new to amateur radio you are probably still sorting out the names of all the different organizations, trying to decide which ones are of interest to you. The Quarter Century Wireless Association (QCWA) is one you won't be joining until you've been in the hobby for at least 25 years, but it is definitely one you should know about.

Since its inception in 1947, the QCWA membership has been dedicated to many worthwhile goals. One that is of special importance to teachers such as myself is their encouragement of young people to become ham radio operators. QCWA has established a program of scholarships awarded to young people in amateur radio who are working toward their formal educations. This program has been highly successful, bringing added prestige to QCWA and at the same time honoring QCWA Silent Key members, in whose name the scholarships are issued.

Through the years, I've had the pleasure of meeting and working with many members of this wonderful organization. They have within their ranks amateur radio operators who lived the history of radio in this country. I've invited numerous members to my classroom to share their experiences with my youngsters. Watching the wisdom and experience of age coupled with the eagerness and curiosity of youth, you know you've got a winning combination in the classroom. The children love hearing the stories and being able to work at the radio with these "experts." The QCWA members love the experience of providing enrichment to the children.

Harry Dannals W2HD

Harry Dannals is the present president of the QCWA. He has always made himself available to help out with activities for young people. Harry has had an interesting background with radio. He was first licensed in 1946 as a teenager with the call W2TUK. In 1976, he received W2HD under the special licensing privilege available to amateur Extra licensees. His father was QCWA Charter Member W2GG/K4GG, now a Silent Key. He is the brother of two radio amateurs . . . W2DRL and FO8JB, also a Silent Key . . . and the father of two radio amateurs . . . WA2FEW and WB2UZU.

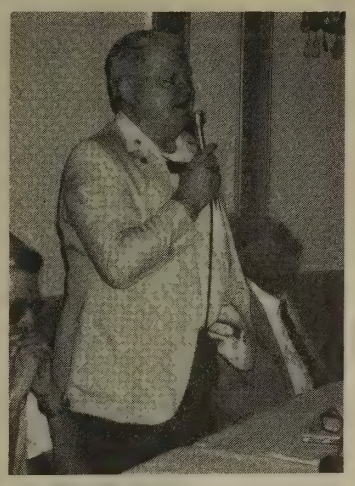

Photo A. Harry Dannals W2HD.

Harry has been active on all amateur bands from 160 meters through 450 MHz. He has participated in many of the facets of our hobby from public service activities through contests and ragchewing. For all of his licensed years, this operation had taken place on Long Island in New York, until 1990 when he began amateur radio activities from his new temporary retirement location in Charlottesville, Virginia. He is active there with the Albemarle Amateur Radio Club and is teaching classes for the General and Advanced licenses.

For more than 40 years, Harry was involved in an active role in the operations of the American Radio Relay League. Some of the volunteer offices he held were: Section Communications Manager, NYC/LI, 1955-1961; Vice Director, ARRL Hudson Division, 1961-1964; Director, 1965-1972; ARRL President, 1972-1982; and ARRL President Emeritus, 1984 to date. In New York City, he was named the first president of the Hudson Amateur Radio Council and was trustee for K2US at the 1964-1965 New York World's Fair.

During Harry's 10 years as president of the ARRL, he visited all 50 states, plus Puerto Rico, the Canal Zone, Canada, Mexico and several overseas countries. During this time he logged more than a half million airline miles.

As soon as he was eligible, Harry became a Life Member of QCWA. He has served as chairman of the Long Island Chapter, National Director (1983-1985) and is presently in his second term as President.

Harry is retired from Sperry (now called Unisys), where he was employed continuously for 38 years. He has been retired for five years from the United States Naval Reserve where he attained the rank of Commander. During a busy regular and reserve career which spanned teens to retirement, Harry was a radio operator, radio/electronics instructor and for the last several years, commanding officer of two Reserve communications activities on Long Island.

W2HD has been married for 40 years to Kay, the gal whose support and understanding during his many years of involvement in amateur radio activities made it all possible. They have two sons, two daughters and 12 grandchildren. Want to bet there will be a few more Dannals hams in the future?

Harry is a proponent of motivating the QCWA membership to support youth radio activities and to get involved with local schools and scouting groups. The following is an excerpt from his President's Message for the QCWA *Winter Journal*.

"The QCWA Board of Directors discussed the subject of 'elmering' at the meeting in Canton, Ohio. We know that there are many members with the time and talent to teach classes in amateur radio at local schools or scout troops. Other QCWA members have an uncanny ability in troubleshooting and repair. Those talented members can conduct troubleshooting clinics at the local club or even at QCWA chapter meetings where newcomers can mix with the old-timers in a cooperative session.

"Amateur radio is undergoing an explosive growth at this time. We members of the QCWA should join this growth by providing that rare capability that we enjoy via our years of experience. The newcomers will welcome your words of encouragement and advice . . .

"You can assist by checking through those old boxes of tubes, some old schematics, and anything else which might assist in putting a newcomer on the air inexpensively."

So if you are an experienced amateur radio operator, consider the important role you can play by getting involved with youngsters who are just starting out. For more information about the QCWA organization, contact Harry Dannals W2HD or write to the QCWA Headquarters at 1409 Cooper Drive, Irving, Texas 75061-5527; phone: (214) 438-8038. RF

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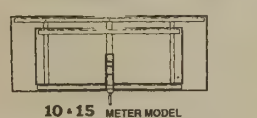

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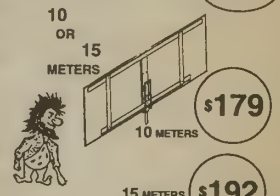

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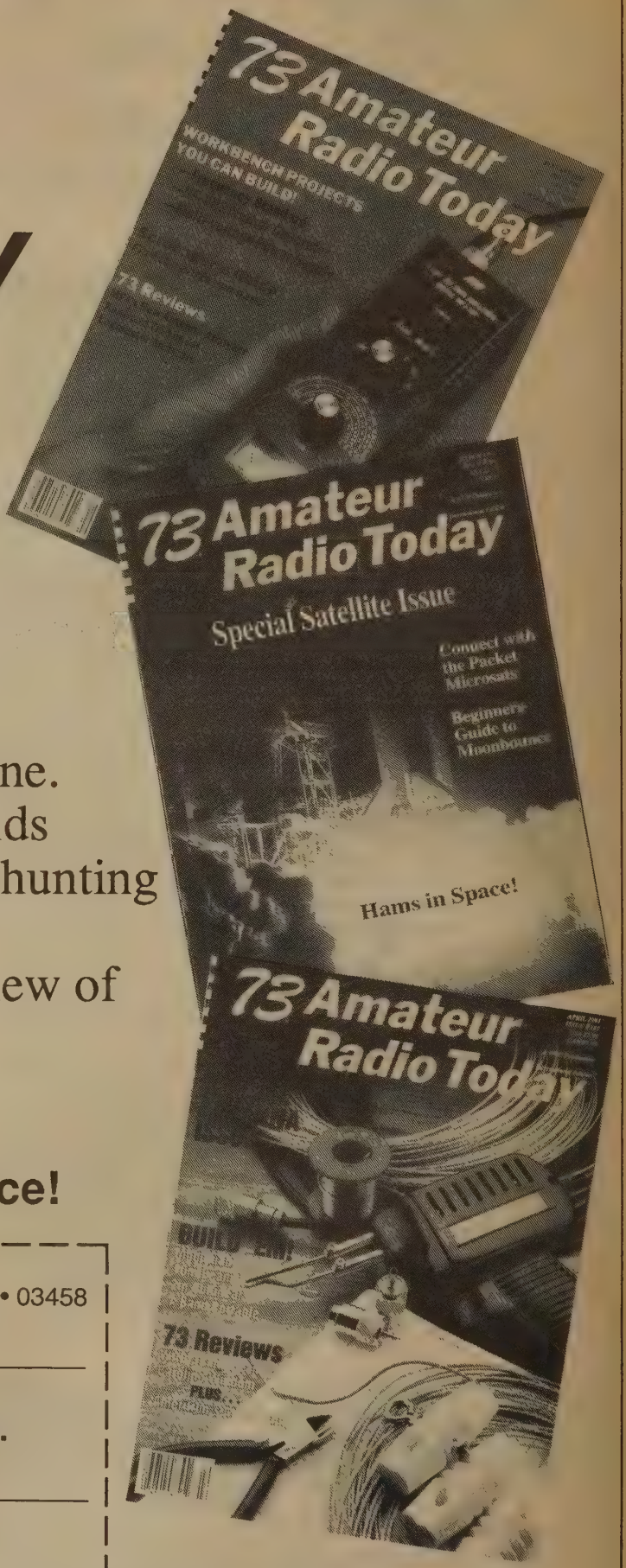

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activities calendar

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We'll print as many as space allows, on a "first come-first listed" basis.

JUL 10-11

MAPLEWOOD, MN *Amateur Fair '92* will be held at the Aldrich Arena, 1850 White Bear Ave. Fri. schedule: Outside Flea Market from 6PM-9:30 PM; Commercial Exhibits from 6 PM-10 PM. Sat. schedule: Outside Flea Market 6 AM-3 PM; Commercial Exhibits 8 AM-3 PM; Grand Prize drawing 2:30 PM. The event is hobby oriented, catering to amateur radio operators, electronics hobbyists, and PC users. Admission is $6. Children under 6 free when accompanied by an adult. Free parking. Ticket holders may sell from the Giant Outdoor Flea Market at no additional cost (no electricity). For info contact ***Amateur Fair, PO Box 26331, St. Paul MN 55126; (612) 653-9999.*** Computer users can call ***HAM-LINK*** at ***(612) 426-0000 (300-9600 baud).***

JUL 10-12

U.S.A./CANADIAN BORDER North Dakota and Manitoba's International Ham Fest will be held at the Peace Garden. Registration will begin on the afternoon of the 10th. The Fest will end at noon on the 12th. Flea Market. Transmitter Hunts. Sun. morning Breakfast for all. The Peace Garden is located just a few miles north of Dunseth ND, or a few miles south of Boissevain, Manitoba. Contact ***Dave Snydal, 25 Queens Crescent, Brandon, Manitoba, Canada R7B-1G1.***

JUL 11

NORTH CHARLESTON, SC The Charleston II Summer Hamfest/Computer Expo will be held from 8 AM-3 PM at the Chas. Southern Univ. Field House, North Charleston SC. Exit-205 I-26, US-78 East. Free parking. Advance tickets: $6 family admission (2+), plus 5 prize tickets. At-the-gate tickets: $5 single admission plus 1 prize ticket. Additional prize tickets: $1/ea. or 6/$5. Auction after 2 PM. Inside Flea Market Tables 1/$10, Addt'l/$7.50 ea.; Dealer Tables (wall space and elec.) 3/$39, 5/$55, addit'l tables $8/ea. Outside vender space and tailgaters: 1st 8' space $3; $8 each addt'l space. Dealer and Flea Market contact: ***Roy Morrow N4ARA, (803) 871-5914 (H); (803) 851-0600 (W).*** Tailgate/Outside Vendor, tour and reservation help, contact: ***John Simons KC4UCP, (803) 875-3135(H).*** Talk-in on 147.27+/224.64-/443.80+.

PETOSKEY, MI The Straits Area ARC will sponsor a hamfest from 8 AM-1 PM at the 4-H Bldg., Emmet County Fairgrounds, 2 blocks W of US 31/131 intersection. VE Exams, Flea Market. Admission $3. 8' tables $3. Talk-in on 146.08/.68 and 146.52. Contact ***Tom Romanauski N8KHE, (616) 436-5033.***

SUMMERVILLE (CHARLESTON), SC The Trident ARC will sponsor *Charleston II—Summer Hamfest & Computer Expo* at the Charleston Southern U. Fieldhouse, I-26 (Exit 205) and US-78 East, from 0800Z-1500Z. Radio, Computer and Software dealers. Set-up at 0600. Wheelchair access. Free parking. Campground and motels nearby. Advance tickets $6 per family; $5 each at the gate. Tailgate $3. Tables $10. Dealers (call). True-Auction at 1400 hrs. Talk-in on 147.27+, 224.64-, 443.80+. Mini-vacation planning assistance. Atlantic Ocean beaches 25 miles. Contact ***Chairman: Bubba Johnson N4CII, 5 Shoo Fly Cir., Givhans SC 29472; (803) 821-8100 (recorder),*** or ***(803) 871-7741.***

JUL 11-12

BILLINGS, MT The Yellowstone RC, Inc., will hold a Hamfair at the Yellowstone County Fair Grounds, Metra Park Turf Club. Shuttle service from Billings Logan Internat'l Airport. Set-up will be all day Fri., Jul 10th. RV parking $9.50 per day, or $22.50 for 3 days, w/electrical hookups. Hotel room discounts are available at the Airport Metra Inn (only $28 per night). Registration fee is $35. Advance tickets $5, $6 at the door (deadline June 30th). Swap Tables: Admission plus $10 each; $5 for half table. Talk-in on 147.200+ MHz, 147.360+ MHz, 3900 kHz. Send check or money order for advance package to ***Yellowstone Radio Club K7EFA, Eileen C. Jones K7BFJ, Club Sec., 1544 Foothill Dr., Billings MT 59105.*** Please SASE. Get more info from ***Vince KB7ADL, (406) 252-8029, eves.; Eileen K7BFJ, (406) 252-2045, eves.;*** or ***Verlon K7AEZ, (406) 245-3930, days.***

JUL 12

OLD WESTBURY, NY The Long Island Mobile ARC will sponsor a Hamfest at the New York Institute of Technology, Route 25A, Old Westbury NY, from 9 AM-4 PM. VHF tune-up clinic. No advance, $5 at the gate. Exhibitors $10. Talk-in on 146.25/.85. Contact ***Neil Hartman WE2V, (516) 462-5549,*** or ***Mark Nadel NK2T, (516) 796-2366.***

AUGUSTA, NJ The Sussex County ARC will hold a Hamfest at the Sussex County Fairgrounds, Plains Rd., off Route 206, starting at 8 AM. Free parking. Admission $4 (XYLs and harmonics free). Tailgate $6. Indoor Flea Market $8 per space (limited supply of tables). Talk-in on 147.90/.30, 222.90/224.50, 146.52. Contact ***Don Stickle K2OX, 185 Weldon Rd., Lake Hopatcong NJ 07849; (201) 663-0677.***

BOWLING GREEN, OH The Wood County ARC will sponsor its 1992 Ham-A-Rama at the Wood County Fairgrounds on Poe Rd., in northwest Bowling Green, starting at 8 AM. Free admission and parking. VE Exams. Trunk sales $5. Inside tables $10. Talk-in on 147.78/.18. Contact ***Wood County ARC, PO Box 534, Bowling Green OH 43402; (419) 352-3260.***

PITTSBURGH, PA The North Hills ARC will hold its 7th annual Hamfest from 8 AM-3 PM at the Northland Public Library, 300 Cumberland Rd. (10 miles north of Pittsburgh on Rt. 19N or McKnight Rd. From I-79 or the Pennsylvania Turnpike, take Rt. 19S through Wexford, turn left onto Cumberland Rd. at the second traffic light after Chunky Cheese. Talk-in will be on 147.09 (the W3BIS Allegheny County Public Service rptr). Limited indoor tables $10 each. Free admission and parking. One free automobile-sized space per tailgater; each additional space $5. Wheelchair accessible. Contact ***Don Jackson N3LAZ, 8 Dale Ave., Bradford Woods PA 15015; (412) 935-3343.***

DOWNERS GROVE, IL The DuPage ARC will sponsor their 10th annual Hamfest/Computer Mart, beginning at 8 AM at the American Legion Post 80, 4000 Saratoga Ave., Downers Grove IL. Post 80 is located about 20 miles west of Chicago, one block north of Ogden Ave. (Rte 34), and one block west of Main St. From I-88 exit at Highland Ave. south to Ogden, west on Ogden one block to Saratoga, one block north on Saratoga to the American Legion Post 80. Flea Market. Tailgating. Free Parking. VE Exams for all classes; please bring your license, copy of license, photo ID and certificate of successful completion, if appropriate. Tickets $3 in advance, $4 at the gate. Talk-in on 146.52 MHz simplex and 145.25 MHz -600, (CTCSS 107.2 Hz). For tickets, tables or info, SASE, or call ***Edwin Weinstein WD9AYR, DARC Hamfest Chairman, 7511 Walnut Ave., Woodridge IL 60517. Ham line (708) 985-9256.***

JUL 17-19

ESSEX, MT The 58th Annual Glacier-Waterton Internat'l Peacepark Hamfest will be held at the Three Forks Campground, Essex MT. Advance tickets (before July 3rd) are $8.50; $20.50 after July 3rd. VE Exams. For registration write to ***Ethel Ferree KA7HEX, Box 75, Wolf Creek MT 59648,*** or call ***Pete KF7R, (406) 222-2601.*** All are welcome. Talk-in on 146.52. For info contact ***Sheila Devitte VE6NOW, (403) 282-2171.***

JUL 18

SALISBURY, NC The North Carolina Chapter of the Triple States RAC, will sponsor a "Firecracker Hamfest" at the Salisbury Civic Center from 9 AM-5 PM. Admission, $3 in advance (with SASE), $4 at the door. No additional charge for Flea Market. Tables in air conditioned area, $5. Set-up at 3 PM-9 PM Fri., 7 AM Sat. FCC Exams by W5YI. ARRL Forum at 10 AM. VEC Exams at 1:30 PM. Pre-registration required with form 610, copy of license, and $5.25 fee. Send to ***Isabell Ledford, PO Box 826, Coolemee NC 27014.*** Talk-in on 146.73 or 146.655. Directions: From Interstate #85, take Hwy. #52 west/East Innes St. Turn left on South Boundary St., the Fest is on the left. For info and pre-registration contact ***Walter Bastow N4KVF, 3045 High Rock Rd., Gold Hill NC 28071.***

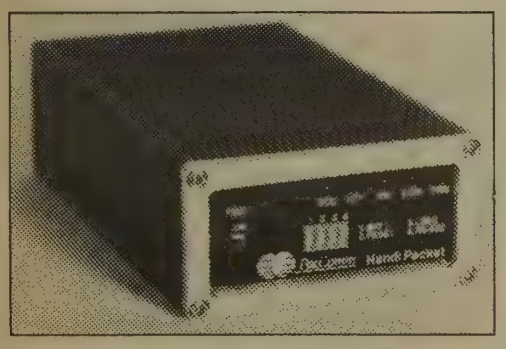
ABILENE, KS The Smoky Valley RC will sponsor a Hamfest from 9 AM-4 PM at Eisenhower Park. VE Exams. Talk-in on 146.88 or 145.33. Contact ***Bill Fenton WØOIN, 315 S. Washington, Junction City KS 66441; (913) 238-7817.***

JUL 19

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club, will co-sponsor a TAILGATE Electronics/Computer/Amateur Radio Flea Market from 9 AM-2 PM at Albany and Main Streets. Admission $2. Free off-street parking. Sellers $8 per space at the gate, $5 in advance (includes 1 admission). Set-up at 7 AM. Call ***(617) 253-3776*** for reservations and info. Mail checks before the 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.***
Talk-in on 146.52 and 449.725/444.725 - pl 2A - W1XM/rptr.

WASHINGTON, MO The Zero Beaters ARC will hold its 30th annual Hamfest at the Bernie H. Hillerman Park (Washington Fairgrounds), from 6 AM-3 PM. Flea Market parking $4 a space. VE Exams (walk-ins, starting at 10 AM—bring original license and a photocopy). Free parking. Free admission. Talk-in on 147.24 and 444.90 rptrs. Contact ***Craig Brune NØMFD, PO Box 24, Dutzow MO 63342; (314) 239-0060 days; (314) 281-2784 eve. and weekends.***

FLINT, MI The 4th annual Swap and Shop, sponsored by the Genesee County RC, will be held at Dom Polski Hall on North Linden Rd., 1 mile west of



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JUL 25

NORTH BEND, OR The Coos County RC will host the 2nd annual Southern Oregon Coast Hamfest at the North Bend Jr. High School from 9 AM—5 PM. Free parking. Free RV parking all weekend. VE Exams. Advance tickets $4, $5 at the door. Tables $15. Large shopping mall within walking distance. Contact ***R. Lyon N7SBF, Coos County Radio Club, PO Box 3494, Coos Bay OR 97420. Tel. (503) 888-2317.*** Talk-in on 146.01/.61 K7CCH rptr.

LANCASTER, PA The Red Rose Repeater Assn. will sponsor a Computer Fest at the McCaskey High School from 9 AM-3 PM. Set-up at 7 AM. Admission $4; children under 14 free with paying adult. Vendor contact: ***Wade Mackey, 5 Sunrise Terr., Millersville PA 17551; (717) 872-5328.***

JUL 25-26

OKLAHOMA CITY, OK The 19th annual Ham Holiday and State ARRL Convention, sponsored by Central Oklahoma Radio Amateurs, Inc., will be held at the Made in Oklahoma Bldg., Oklahoma State Fair Park. Doors open at 8 AM both days. Giant Flea Market, new and used equipment, VE Exams on Sat., RF Foxhunt, packet, computer, AMSAT, etc. Dinner Sat. eve.; QCWA Breakfast Sun. morning. Advance tickets $6, $8 at the door. Tables $5 in advance, $7 at the door. Talk-in on 147.03/.63. Contact ***Ham Holiday 1992, PO Box 95942, Oklahoma City OK 73143-5942.***

JUL 26

MILFORD, CT The Coastline Amateur ARA will hold VE Exams for all classes at the Fowler Bldg., 145 Bridgport Ave., at 12 noon. Walk-ins. Contact ***Gary NB1M, (203) 933-5125,*** or ***Dick WA1YQE, (203) 874-1014.***

TIMONIUM, MD The BRATS Maryland Hamfest/Computer Fest will be held at the Maryland State (Timonium) Fairgrounds on York Rd., off I-83 and I-695, from 6 AM-3 PM. Admission $5 per adult; children under 12 free. 8' tables in the Main Exhibit Hall are $50 each (includes AC power and one admission ticket). 8' tables in the Home Arts Bldg. are $25 each, no AC power; admission is additional. Set-up at 2 PM Sat. Tailgate area set-up 2 PM Sat., $5 per vehicle space. Buyers, please note: This is *not* a 2-day hamfest. Sat. PM access is for dealer and tailgating set-up *only*. VE Exams Sun. at 10 AM in Administration Bldg.; mail your completed Form 610 to ***John Creel WB3GXW, 3208 Kilkenny St., Silver Spring MD 20904.*** For tables, info, write to ***BRATS Hamfest, PO Box 5915, Baltimore MD 21208***, or call Table Chairman ***Franz Niedermeyer N3HFS, (410) 583-9147*** anytime.

AUG 1

COLUMBUS, OH The Voice of Aladdin ARC will host a Hamfest from 8 AM-5 PM at Aladdin Shrine Temple, Morse Rd. and I-270 Juction on the east side of Columbus. Advance tickets $3, $4 at the door. Flea Market/Trunk sales $2 per vehicle. Tables $5 in advance, $6 at the door. Advance registration preferred. Make checks payable to ***Voice of Aladdin ARC*** and mail with requests and SASE to ***James C. Caines KB8KME, 1056 Erickson Ave., Columbus OH 43227-1241.*** Walk-in VE Exams.

AUG 8

HUNTINGTON, WV The Tri-State ARA will sponsor Hamfest '92 & Computer Show starting at 8 AM at the Huntington Civic Center. Set-up at 6 AM. Walk-in W5YI testing for all license classes. Wheelchair accessible. YL and XYL activities. Close to all accommodations and restaurants. Donation, adults $5, children 12 and under, free. For more info, call ***Bill KF8QK, (304) 522-1933,*** or ***Alan N8LNS, (304) 736-9303,*** anytime.

AUG 14-16

PARK CITY, UT WIMU '92 and the ARRL Rocky Mountain Div. Convention will be at the Olympia Hotel. Phone ***1-800-234-9003*** for reservations; mention WIMU '92 for special rates. VE Exams Fri. at 6 PM; call ***NV7V, (801) 465-3983*** to register. UARC is sponsoring a Steak Fry Sat. at 6 PM; $12 per person. Swap meet starts Sat. at 8 AM, no charge for tables. Sun. at 8 AM, an All-You-Can-Eat Buffet, $6.95 per person. Pre-register before Aug. 1, $10; after Aug 1 and at the door, $15. Children under 12 may register at any time for $4. Send registration requests and checks to ***WIMU '92, PO Box 67, Bountiful UT 84011-0067.*** You *must* be registered to attend these events.

SPECIAL EVENT STATIONS

JUN 28-AUG 13

SEQUOIA NATIONAL FOREST, CA Radio Station N6PZA will be operating portable from Boy Scout Camp Whitsett, on a when-time-permits basis. Camp Whitsett is located in the southern portion of the Sierra-Nevada Mountain Range, 32 mi. north of Kernville CA. Operation will be in the 40 and 17M bands Mon.-Fri. during 2100-2400 UTC; and 17 and 20m Mon.-Thurs., 0100-0400 UTC, with occasional operation on 10m. Send inquires to ***Chuck Smith N6PZA, PO Box 1867, Lake Isabella CA 93240-1867.*** We would like to establish a possible Scout/Summer Camp Net with all Boy or Girl Scouts, Scout leaders, or Ham Radio licensed Camp Staff members who work at Boy or Girl Scout or other Youth Camps during the summer. Listen for Camp Whitsett on the General portions of the Ham Bands (especially 17, 20 and 40m) during the day.

JUL 2-12

CALGARY, ALTA. CANADA Station CJ6CEXS will operate from the Calgary Stampede, to celebrate the 125th anniversary of Canada. There will be a 8 x 10 full color poster award for $5 U.S. funds. Any contact on any mode/band qualifies. Special QSL cards will be sent out. Talk-in on 146.850 -600 VE6RYC rptr. On the grounds, use 146.520 simplex. ***QSL via VE6NAO.***

JUL 4

DELTAVILLE, VA The Middlesex AR Group will operate AC4OG, 1230-2030 UTC to commemorate Deltaville's 4th of July Celebration. Operation will be in the General portion of the 80, 40 and 20m bands. For certificate, send QSL and SASE to ***Pat Muller AC4OG, M.A.R.G., PO Box 148, Locust Hill VA 23092.***

NEILLSVILLE, WI Station N9MCH will be operated by the Clark County ARES, from the Highground Veterans Memorial Park located 2 1/2 miles west of Neillsville, in southern Clark County, just off US Hwy. 10. The station will operate from 1700Z-0500Z (12 PM noon CDST to 12 AM midnight CDST). Frequencies: The bottom portion of the General 80m, 40m, 15m, and 10m phone subbands. For a Certificate, send your QSL and a 9 x 12 SASE to ***The Highground, PO Box 457, Neillsville WI 54456.***

PISCATAWAY, NJ N2HOQ will operate the first 326 minutes (0000-0526Z) to celebrate the 326th Anniversary of the town. RTTY only on various HF bands. For certificate, send QSL and 9 x 12 SASE to ***Geoff Malta, PO Box 312, Piscataway NJ 08855.***

STAUNTON, VA The Valley ARA will operate Station WB8GIF in con-

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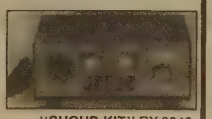

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JUL 4-5

BUFFALO, NY/FT. ERIE, ONT. CANADA The South Towns ARC will operate Station WB2ELW and Niagara South ARC will operate Station VE3NKH, to commemorate the 65th Anniversary of the opening of the Peace Bridge over the Niagara River (connecting Buffalo NY and Ft. Erie Ont.). They are also celebrating the annual Friendship Festival commemorating 180 years of friendship between the U.S. and Canada. Operation will be in the lower 25 kHz of the General phone subbands, the Novice 10m phone subband, the CW General subbands, 10m Novice CW subband, the WB2ELW rptr., 147.09 MHz (+600 kHz transmitt) and the VE3NKH rptr., 147.165 (+600 kHz transmitt). For certificate: US amateurs send QSL and SASE to ***John Leiten WB2ELW, 6120 McKinley Pkwy., Hamburg NY 14075***. Canadian amateurs, send QSL and SASE to ***John Gilmour VE3NKH, 158 High St., Fort Erie, Ont. Canada L2A 3R1.***

JUL 10-11

PEACE GARDEN, NORTH DAKOTA/MANITOBA BORDER In conjunction with their 29th North Dakota/Manitoba International Hamfest, VE4IHF/0 will be in operation as a Special Event Station. Operation will be from 9 AM-5 PM. Frequencies: 3.937, 7.255, 14.255, 21.355 and 28.355, plus or minus.

JUL 11-12

U.S./CANADA Amateurs affiliated with the American Sunbathing Assn., The Naturist Society, and Federation of Canadian Naturists will sponsor operation of as many as 12 SE stations (40-2 meters; 10 AM-3 PM local time) to celebrate National Nude Weekend. For certificate, indicating all sites worked, send QSL(s) and 9 x 12 SASE to ***AE3D, PO Box 5407, Laurel MD 20707-5407.***

NORWOOD, NY The St. Lawrence County 10m Assn. will operate WN2R to celebrate the annual "Norwood Regatta" at Norwood NY. Operation will be on the General portion of 40m and 20m and the Novice portion of 10m from 12 noon-7 PM, EDT. For a special QSL, send QSL and SASE to ***Regatta, General Delivery, Norwood NY 13668.***

JUL 15

ATKIN, MN The Barton Amateur Radio Family will operate K0PVB from 1800Z-2400Z to commemorate their 40th annual visit to Sunset Bay on Cedar Lake. Operation will be in the 40, 20, 15 and 10m bands. For a certificate and honorary membership in B.A.R.F., send QSL and SASE to ***B.A.R.F., c/o KAØWOW, 1441 West 41st St., Davenport IA 52806.*** SWLers encouraged to respond.

JUL 11-12

FULTON, NY The Oswego County Amateur Radio Emergency Service will operate KY2F from 1200Z-2100Z each day, from the Central New York Internat'l Air Show at the Oswego County Airport. Frequencies: The middle of the General 80, 40, 20, 15, and 10m phone bands; Novice portion of 10m, 147.75/.15 MHz., and packet on 145.05 MHz. For certificate, send your QSL card and a large SASE to ***Fred Swiatlowski KY2F, PO Box 5227, Oswego NY 13126.***

JUL 11-19

WOOSTER, OH The Wayne AR Technical Soc. will operate N8CEY 1200Z for 15 hours Jul. 11-19 to celebrate the Ohio Agricultural Research and Development Center, "A Century of Science" at Wooster. CW: 3.550, 7.050, 10.125, 14.050, 21.050, 24.920, 28.150; Phone: 3.900, 7.275, 14.275, 21.350, 24.960, 28.350. For certificate, send QSL and a SASE to ***OARDC, Mike Brugger N8CEY, 1680 Madison Ave., Wooster OH 44691.***

JUL 12

LA GRANGE PARK, IL The Six Meter Club of Chicago will operate K9ONA 1400Z-2359Z to commemorate the centennial of La Grange Park. Frequencies: Novice portion of 10m, and 146.37/.97 K9ONA rptr. For QSL, send SASE; for certificate, send 9 x 12 SASE to ***K9ONA, Karl Weisshappel, 802 Barnsdale Rd, La Grange Park IL 60525.***

JUL 18

DENVER, CO The Rocky Mountain Radio League will launch a high altitude balloon carrying a cross-band rptr. with the ID of NØFVG BALLOON REPEATER, at 1400Z. The input frequency will be 446.000, with the output of 147.555. The expected max. altitude will be close to 100,000 feet. Stations 500 miles from Denver should be able to check in. Flight duration will be about 4 hours. There will be a conducted net on this rptr. All stations that check in will be sent a commemorative QSL card. Send your QSL card with an SASE to ***Warren Gretz NØFVG, 3664 E. Lake Dr., Littleton CO 80121.***

JUL 18-19

STATEN ISLAND, NY The Staten Island ARA will operate W2CWW from Sat. at 1200Z-1500Z Sun., to celebrate their 70th Anniversary with the ARRL. Operation will be in the lower 25 kHz of the General 80, 40, 20 and 15m phone subbands, and the Novice portion of the 10m phone subband. Also 445.325 -5 156.7pl club rptr. For a Certificate suitable for framing, send your QSL with a 9 x 12 SASE to ***Staten Island ARA, PO Box 140495, Staten Island NY 10314-0018.***

TALLADEGA, AL The Talladega RAC will operate Station AA4UF from the Third Annual Induction of the International Motor Sports Hall of Fame, Jul. 18 from 1300Z-0500Z, and Jul. 19 from 1300Z-2300Z on 14.270 MHz (+/- QRM), in the 20m phone band and the middle of the 10m Novice phone band. For a Certificate, send QSL and two units of postage to ***TRAC, PO Box 626, Talladega AL 35160.***

JUL 24-AUG 8

MONTREAL, QUEBEC, CANADA Station CI2M will operate daily, Jul. 24-Aug. 8, from 1300-0100 UTC, to commemorate the 350th Anniversary of Montreal. Frequencies: SSB: 3.875, 7.250, 14.250, 21.350, 28.350 +/- QRM. SSTV: 14.230; Packet: 145.03; ATV: 439.25; VHF: 50.135, 147.045. A special QSL card will be available. Please QSL with SASE, or via VE2 bureau to ***CI2M via VE2CUA, Concordia University ARC, c/o CUSA H-637, 1455 DeMaisonneuve West, Montreal, Quebec, Canada H3G 1M8.***

JUL 27-AUG 2

CANTON, OH The Canton ARC will operate Station W8AL from 2200-0200 UTC Jul. 27-Jul. 31; and from 1700-2300 UTC Aug. 1-2, to celebrate the Pro Football Hall of Fame Greatest Weekend. Frequencies: SSB: 28.350, 21.350, 14.270, and 7.270; CW: 28.150, 21.060, 14.060, and 7.060. There will also be RTTY, Packet, Amtor, and 2m FM operation. SWLs welcome. For an unfolded Certificate, send your QSL and a 9 x 12 SASE, with two units of first class postage. For a QSL or a folded certificate, send your QSL and a #10 (business size) SASE to ***Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306.***

JUL 31-AUG 2

DARMSTADT, GERMANY The Wiesbaden ARC will operate DA1WA/P from Frankenstein Castle, on all bands 80-10m, CW, SSB, Packet, and digital modes. A special QSL card has been printed especially for this event. QSL to ***DJ0PU,*** SAE with 2 or 3 IRCs or "greenstamps." For more info, contact ***Rob Kipp DJØPU, Huegelstr. 25, D-W-6070 Langen, Germany.***

AUG 1-16

LEWISTOWN, PA The Juniata Valley ARC will operate Station K3DNA in celebration of the 25th Anniversary of the US Canoe Assn. Nat'l Championships. Frequencies: The General portion of the SSB band as well as on CW. Most operation will be during the week of Aug 1-8. For a special Certificate, send an SASE to ***K3DNA, PO Box 73, Yeagertown PA 17099.***

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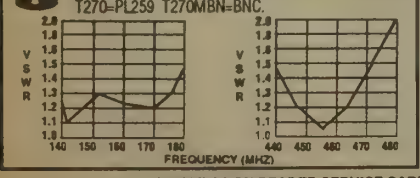
MODEL # T270 $18.95
SPECIFICATIONS
The T270 mobile dualband motorola (NMO) mount antennas are designed to provide years of satisfactory operation. They bring dual band operation to discriminating users of both amateur and commercial equipment. These antennas are designed to enhance the capabilities of portable equipment. The NMO mounting is a reliable method to ensure good continuity for many years to come. These antennas are supplied with a spring loaded positive pressure contact.
VSWR at resonance is typically 1.5:1 or less
Power rating is 200 Watts P.E.P. Unity gain 140-170 Mhz, 2.5 db gain 440-470 Mhz, Weight is approx. 1lb.; Color: Black; Impedance: 50 ohms

$23.95 MODEL # T270M
MODEL # T270MBN
SPECIFICATIONS
The T270M and T270MBN mobile dualband magnetic mount antenna kits are designed to provide years of satisfactory operation. They bring dual band operation to discriminating users of both amateur and commercial equipment. These antennas are designed to enhance the capabilities of portable equipment. The heavy duty magnet insures reliable operation at speeds up to 100 M.P.H. The base comes with a protective mylar to prevent damage to any mounting surface. These antennas are supplied with 12' of RG58A/U coax and a choice of connector T270=PL259 T270MBN=BNC.



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BP-7	13.2v	500mah	$23.00
BP-8	8.4v	800mah	$21.00
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PB24 Tabs	9.6v	600mah	$15.00
PB-25/26	8.4v	500mah	$18.00

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FNB-11	12v	600mah	$30.00
FNB-12	12v	500mah	$30.00
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San-Tec #142#144 Tabs	600mah	$22.00
Azden 300 Tabs	600mah	$15.00
Bearcat	600mah	$20.00
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BP-8	8.4v	800mah	$60.00
BP-7S	13.2v	1200mah	$59.00
BP-8S	9.6v	1200mah	$59.00

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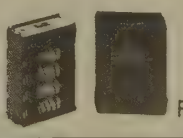
BP-BH $20.00
BP-BH with 8 NiCad cells $26.00



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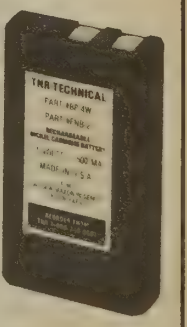
FNB-14	7.2v	1000mah	$48.00
FNB-14S	7.2v	1400mah	$59.00
FNB-17	7.2v	600mah	$35.00



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CIRCLE 62 ON READER SERVICE CARD

Radio Fun flea market

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The *Radio Fun Flea Market* costs you peanuts (almost)—comes to 10 cents a word for individual (noncommercial) ads, and 70 cents a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad. This is a monthly magazine, not a daily newspaper, so figure a couple of months before the action starts; then be prepared. If you get too many calls, you priced it too low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right, and maybe you can help make a ham newcomer or retired old-timer happy with that rig you're not using.

Send your ads and payment to *Radio Fun Flea Market*, Sue Colbert, 70 Route 202 N, Peterborough NH 03458, and *get set for the phone calls.*

MORSE CODE MUSIC? Yes it's true! Now the Morse Code alphabet can be learned and enjoyed while doing aerobics, jogging, driving, or dancing. Order **"RHYTHM OF THE CODE"** cassett single hit today! Send $5.95 (plus $2 S+H) to Kawa Productions P.O. Box 319-R, Weymouth MA 02188. For information send SASE. RF247

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MINIATURE POLICE RADAR TRANSMITTER one mile range, $41 assembled, $31 kit, (219) 489-1711. P.O. Box 80096, Fort Wayne IN 46898. RF251

WANT MY "CLEANING SHACK" LIST? Send LSASE. Lewalski, 3512 Moraga Blvd., #4102, Lafayette CA 94549. RF255

IN NEED OF ANY AMATEUR RADIO EQUIPMENT for the disabled and handicapped. Please send inquiries or call: Julian Flores KD6CFK, 505-836-0691. 1917 Sunset Gardens SW, Albuquerque NM 87105. RF257

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WANTED: Pre-1980 microcomputers for museum collection. KK4WW. 703-231-6478, 703-763-3311. RF552

JUST IMAGINE YOUR OWN 25 TO 50 ACRE cool, green mountaintop QTH in the Blue Ridge Mountains, only $995 per acre. Wild game, great views, ideal for hamming, retirement or summer home. KK4WW, Floyd VA. 703-763-3311. RF553

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TRADE IBM COMPATABLE SOFTWARE Especially Ham Radio, any type of shareware, public domain. SWAP LISTS. Donald Wahle, Box 1244, Jacksonville OR 97530. RF800

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new products

EEB

Lowe receivers are now available in the U.S. and Canada. The new compact, go-anywhere HF150 is rugged, portable and performs like a giant. It covers 30 kHz to 30 MHz, AM, AMN, USB and LSB, plus four AM synchro detection modes. It also includes 60 memories, a large LCD readout, 10-15 VDC, and 150 mA operations. Available options: keypad, NiCds (8AA), whip antenna, 120 VAC adapter. This unit is a great companion for a QRP field operation. It's just 7.3" x 3.2" x 6.3", weighs 2.9 pounds, and comes in a rugged metal alloy case.

For prices and more information on the Lowe HF150, contact *Electronic Equipment Bank, 323 Mill Street N.E., Vienna VA 22180; (703) 938-3350, (800) 368-3270, Fax: (703) 938-6911.* Or circle Reader Service No. 201.

AZIMUTH COMMUNICATIONS

The new Azimuth WeatherSTAR Generation II Stations feature greatly expanded state-of-the-art capabilities, with virtually all weather functions now available to the user: wind, temperature, rain, humidity, barometric pressure. Build a system to fit your needs; at your option you can add rain, outside humidity and dew point, and the most exciting computer interface capabilities ever available on a stand-alone system. Generation II gives everything you ever wanted at a cost affordable to the home weather enthusiast as well as to companies and weather professionals.

WeatherSTAR Wizard II includes all the most requested features: inside and outside temeratures, wind direction and wind speed. The WeatherSTAR Monitor II, the top-of-the-line model, includes all these features plus barometric pressure and inside humidity. Both units record highs and lows and tell you the time and date they occurred. A Rain Collector (RG4) can be added to either Wizard II or Monitor I, allowing you to measure daily and accumulated rainfall. An External Humidity/Temperature Sensor can be added to the Monitor II to let you track outside humidity and dew point.

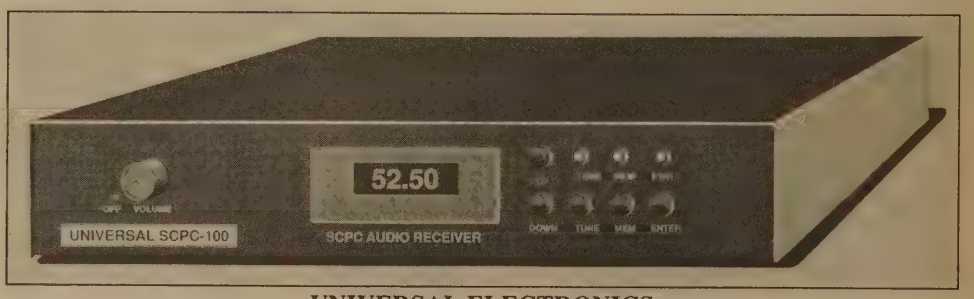
After July 1, 1992, the WeatherSTAR Wizard II will be priced at $259.95 and the WeatherSTAR Monitor II at $399.95, plus shipping and handling. For more information, contact *Azimuth Communications Corp., Dept. 73, 3612 Alta Vista Ave., Santa Rosa CA 95409; (707) 577-8007, (800) 882-7388, Fax: (707) 573-1482.* Or circle Reader Service No. 203.

TIGERTRONICS

Tigertronics has announced a revolutionary breakthrough in packet technology with the new Model BP-1 Packet Modem. Specially designed to work with TNC emulation programs like BayCom and SofTnc, the BP-1 transforms an IBM compatible computer into a full-featured packet controller.

Extremely easy to install, the BayPac simply connects between the computer's serial port and the radio with a small four-conductor cable. This radio cable features a "quick connect" plug, allowing the modem to be moved very quickly to other radios (base, mobile, hand-held). The Digital Signal Processor in the BP-1 is crystal-controlled, auto-calibrating, and never needs alignment.

Not much larger than a book of matches and weighing a scant 1.3 ounces, the unit requires no external power supply and sells for just $49.95. Contact *Tigertronics, Inc., 400 Daily Lane, P.O. Box 5210, Grants Pass OR 97527; (503) 474-6700, (800) 822-9722.* Or circle Reader Service No. 202.



UNIVERSAL ELECTRONICS

Universal Electronics has announced their new SCPC satellite audio receiver. This new microprocessor-controlled receiver will tune and receive hundreds of SPC channels on many domestic satellites. The SCPC-100 unit is easy to install and features 50 channels of memory recall with one button. It is compatible with all 950-1450 MHz block systems, has a large LED tuning scale and will receive all C and KU band channels. It was designed for easy use with all home satellite systems and is the first quality SCPC unit at an affordable price. The hundreds of SCPC services on the satellites include sports, news services, radio nets, home-town sports, racing nets, talk shows, music (classical, jazz and rock), financial programming and more.

The SCPC-100 retails for under $400 and is available from *Universal Electronics, Inc., 4555 Groves Road, Suite 13C, Columbus OH 43232; (614) 866-4605, Fax: (614) 866-1201.* Or circle Reader Service No. 204.

Uncle Wayne's Bookshelf

BOOKS FOR BEGINNERS

20N018 **Technician Class License Manual: New No-Code *by Gordon West*** This book will cover everything you need to become a Technician Class Ham. Every exact question and answer on the examinations is found in this one book covering element 2 and element 3A question pools. Gordon West tells you the right answer and then explains in detail why the answer is correct. Fully illustrated text, frequency chart showing privileges, list of examiners and an FCC Form 610 application. **$9.95**

20N092 **The Wonderful World of Ham Radio *by Richard Skolnik, KB4LCS*** This book addresses the plea that something simple, clear, and fun be written to introduce young people to amateur radio. Pick up one for the new ham in your life. **$7.95**

20N099 **Digital Electronics Projects for Beginners *by Owen Bishop*** contains 12 digital electronics projects suitable for the beginner to build with the minimum of equipment. 128 pp., 56 line drawings **$12.50**

20N100 **Electronics Build and Learn (2nd edition) *by RA Penfold*** combines theory and practice so that you can 'learn by doing.' Full construction details of a circuit demonstrator unit that is used in subsequent chapters to introduce common electronic components. Describes how these components are built up into useful circuits, oscillators, multivibrators, bistables, and logic circuits. 128 pp., 18 photos, 72 line drawings. **$12.50**

AR2073 **Novice Antenna Notebook** A beginner's guide to easy and effective antennas and tuners you can build. **$8.00** An ARRL Publication.

AR2871 **W1FB's Help for New Hams *by Doug DeMaw W1FB*** Complete for the newcomer. Put together a station and get on the air. **$10.00** An ARRL Publication.

AR2286 **First Steps in Radio *by Doug DeMaw W1FB*** Series of *QST* articles. See components assembled into practical circuits and how the circuits make up your radio gear. **$5.00** An ARRL Publication.

AR3291 **Now You're Talking!: Discover the World of Ham Radio** Successor to the immensely popular *Tune in the World with Ham Radio*. Covers everything you need to know to earn your first Amateur Radio license. More than a study guide, this book will help you select equipment for your ham radio station and explain how to set it up—everything you'll need to know to get on the air! An ARRL Publication. **$19.00**

AR3292 **Your Introduction to Morse Code: Practice Cassettes** companion code course to *Now You're Talking!*, this kit includes two 90 minute cassette tapes. Prepares you for the 5 WPM Morse code exam to earn your Novice license or add high-frequency worldwide communications privileges to your code-free Technician license. **$10.00**

SHORTWAVE

06S57 **1992 Passport to World Band Radio *by International Broadcasting Services, Ltd.*** You can have the world at your fingertips. You'll get the latest station and time grids, the 1992 Buyer's Guide and more. 384 pages. **$16.50**

07R25 **The RTTY Listener *by Fred Osterman*** New and expanded version. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter*. It contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. 224 pages. **$19.95**

09S42 **The Scanner Listener's Handbook *by Edward Soomre N2BFF*** Get the most out of your scanner radio. Covers getting started, scanners and receivers, antennas, coaxial cable, accessories, computer controlled monitoring, more. **$14.95**

03S208 **Radioteletype Press Broadcasts *by Michael Schaay*** Covers schedules of Press Services by time, frequency, and country broadcasting in English, French, German, Spanish, and Portuguese. Detailed Press Agency Portraits. 120pp. **$12.95**

03K205 **Guide to Radioteletype (RTTY) Stations *by J. Klingenfuss*** Updated book covers all RTTY stations from 3MHz-30MHz. Press, Military, Commercial, Meteo, PTTs, embassies, and more. 105 pp. **$12.95**

11RF13 **The "Top Secret" Registry of US Government Radio Frequencies (7th Ed.) *by Tom Kneitel K2AES*** This scanner directory has become the standard reference source for frequency and other important information relating to the communications of federal agencies. 25 to 470 MHz. **$19.95**

11F52 **Ferrell's Confidential Frequency List *compiled by A.G. Halligey*** All frequencies from 4MHz—28MHz covering ship, embassy, areo, Volmet, Interpol, numbers, Air Force One/Two, more 376 pp. **$19.50**

11EE06 **Guide to Embassy Espionage Communications *by Tom Kneitel K2AES*** Candid and probing examination of worldwide embassy and (alleged) espionage communication systems and networks. Extensive nation-by-nation directory of embassy stations is included. **$10.95**

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IBM06, COM06 **IBM/Commodore Tech No Code—Lanze Code Program contains all the authorized FCC questions and answers used in testing formulas, schematic symbols, diagrams, and sample test for passing the new Technician No Code license. $24.95**

ANTENNAS

05A95 Easy-up Antennas for Radio Listeners and Hams *by Edward M. Noll* Like to learn how to construct low-cost, easy-to-erect antennas? Easy-up Antennas will help you. **$16.50**

01A70 **Practical Antenna Handbook *by Joseph J. Carr*** Design, build, modify, and install your own antennas. Carr, a 20-year veteran of technical writing, has a unique ability to present complex technical concepts in an easy-to-understand way. 416 pp. **$21.50**

UHF/VHF/PACKET

10A347 **All About VHF Amateur Radio *by William Orr W6SAI*** DX propagation, VHF yagi and quad beams, repeaters and how they work, OSCAR satellites and how to use them. **$11.95**

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RF0792

letters

Continued from page 5

to 80 and 160 meters. I have found that the hardest part of CW is not learning to receive—the hardest part is calling CQ for the very first time. Am I the only one in this boat? I can read the mail easily at eight to 10 words per minute; in fact, I listen to QSOs for at least 20 minutes a night. However, when I hear a station calling at an easy rate, I freeze up. I guess I'm too nervous that someone will hear me totally botch a message; after all, there are millions of people listening to me, aren't there?

I remember a class I had several months ago. We watched a video of a speaker who was a specialist in the field of stress. He was talking about a community in the Soviet Union where it was common for people to live a hundred years. Doctors examined these people. They were human, like us. They studied what they ate and where they lived. Nothing special. They later found out that as people grew older in his community, more responsibility was placed on them. It was this stress that helped them live to such ages. The lecturer then went on to say that when you retire, if you choose a lifestyle with no stress, within two years you'll be dead or senile.

I figure this fits in well with amateur radio. Since so many hams are retired, they'd better get jumping and do something quick. I realize many retirees are very active and I hope to be the same way someday. But, if all you like to do is bitch on the radio and watch "Wheel of Fortune," be careful you don't start repeating yourself. Who better than a retiree to head up club activities. After all, many have the time, and many have a lifetime of radio behind them. All I'm trying to say is get involved in your local ham activities. If there isn't anything happening nearby then start something. Some of the local retirees here (who received their licenses within the past year or so) helped start a new net on 80 meters (3.730 MHz Fridays at 10:00 EST). The net is mainly for people who send CW at a slower rate. A final note on this topic: Older people have the greatest wisdom and never make mistakes. This is because they have outlived all those who have seen them screw up.

I've been reading Wayne's harping over our waning contributions to the world of technology. *[Ted is refering to our publisher, Wayne Green, and his editorials in our sister publication,* 73 Amateur Radio Today.*—Ed.]* This is true. My aspiration is to be a police officer. At best, I'll build outdated equipment from old ARRL handbooks. However, maybe our salvation lies in other areas. Such areas might include society-based issues. For as long as I can remember I have been a shy child. Radio has acted as therapy for me by making me talk to people I've never met before. If you don't believe it helps, I'm talking to you, aren't I? We are a society of communicators and for the most part we are pretty poor at it. Amateur radio, believe it or not, can better society by teaching us how to talk! Where else but in Hamdom can we have such personal communication with individuals we've rarely (if ever) met in person. Socially, radio is beneficial because it teaches us how to start a conversation.

The fun use of radio must be shown to children. Play hi-tech practical jokes on them, or involve them in one. I have the same remote control for my TV as my girlfriend does. One day she and I hid in the bushes outside her family room window. As her brothers were watching cartoons, we would change the channels. They went to get their mother to show her, but when mom was there everything worked fine. They didn't get much of a kick out of it, but we did.

Another good hook is to let them listen to the local police, ambulance, etc. My first involvement with radio was the purchase of a scanner. From my experience, young and old like to listen to the cops. HINT: If you let kids listen to the scanner, stick around so you can help explain what the police are talking about. Do you know what a 10-50 PD is?

To wrap up this letter: Radio can benefit the population. It can help with bonding between parents and children. Maybe that's what it takes to help keep kids off drugs. The deciding factor of our outcome isn't up to the WARC, it's up to us, and we have to make it work. RF

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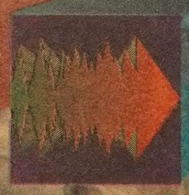

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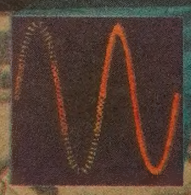

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